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T. COMMERFORD MARTIN and JOS. WETZLER, M. E., Editors.

WM. A. ROSENBAUM, Editor Patent Department.

WALTER T. HUNT, Advertising Department

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VOL. XIV. NEW YORK, AUG. 10, 1889. No. 6.

The Convention Bulletin. AS USUAL, THE ELECTRICAL WORLD will issue at the Niagara Falls convention its well-known and useful Bulletin of the National Electric Light Association. We shall be greatly obliged to all who are in attendance for any help they may be able to afford us in making the Bulletin complete in its list of names, etc.

Convention Greetings. THE present issue of THE ELECTRICAL WORLD is necessarily sent to press before the convention of the National Electric Light Association begins at Niagara Falls, and, coming so quickly after our issue of Aug. 3, leaves little to be said that has not been said already in regard to that meeting. We may take the opportunity, however, of expressing the wish that the members and their friends may spend an enjoyable and profitable week, and be cheered and stimulated by all they learn respecting the great industry with which they are identified. At such times it is well to mark the progress that has been made, and we have no doubt that the statistics presented by President Weeks will tell of another season of development and prosperity. Such an issue as the present one of THE ELECTRICAL WORLD may also serve to exemplify the advancement made, with its profuse illustrations and its numerous interesting articles relative to electric light and power plants.

Canada and the Conventions. THE meeting of the National Electric Light Association at Niagara Falls on Aug. 6, and that of the Edison Association at the same place on Aug. 13, ought, among other good results, to give an impetus to electric lighting in Canada. So far, few Canadian electric light men have participated in these gatherings, but it is to be hoped and expected that they will now take advantage of the chance given them, and fraternize with their fellows in this country.

Utilizing Water Power. THE visit of the National Electric Light Association to Niagara very naturally draws attention to the question of utilizing some of the power that there runs to waste in quantities well-nigh incalculable. Our issue this week will be found to contain more than one pertinent article on the subject, including a description of a feasible plan suggested for Niagara itself and some account of work done or proposed elsewhere. To many persons it is little less than a crime to talk about utilizing Niagara, but there are various ways of saving some of the power without in any way affecting the volume and beauty of the Falls.

The Chicago Electric Club. THE celebration in which the Chicago Electric Club has indulged this week, in connection with the formal opening of its new quarters, is one upon which electricians everywhere throughout the country will felicitate their Chicago brethren. The Club is already a body of importance, and while it has done much to promote social intercourse, it has also done definite work of a useful nature in the promotion of electrical science and technique. Under its present strong management, the Club bids fair to grow rapidly and to become a permanent power for good in the capital of the West.

The One-Mill Telegraph Rate. THE more the new telegraph rate for government messages is discussed the more absurd does it become. Postmaster-General Wanamaker now says that it was not his intention to *fix* so low a rate as one mill per word, but that his order was merely a proposition. It certainly did not read so, and such an excuse does not put the matter in any better light. The Postmaster-General ought to be well advised before he makes even a "proposition" to cut down telegraph rates to one-tenth of what they were before. The probability is that the new tariff will be dropped. There is no good reason why the old one should not be adhered to. It was surely low enough.

Submerged Water-Power. AMONG the many suggestions for the utilization of the water-power of rivers, that of deriving it from floats or paddles attached to craft moored in the current has been broached very often. Indeed, such a power installation has been at work for some time in one of the rivers in Russia with fair success. Our readers will also remember that several patents on a like arrangement have been taken out in this country, and that it has been proposed to apply the system to the utilization of the power of the rapids above Niagara Falls. A contributor in this week's issue unfolds a plan of this nature, in which he proposes to submerge the entire power station. We cannot say that we consider the scheme a highly practical one, or that it presents as good a solution of the problem as those offered by others for this purpose.

A Huge Thermo-pile. IN this issue we bring to a close the series of articles on the practical application of the thermo-electric principles enunciated by Mr. Arthur Rust. Whether the theories or opinions advanced by Mr. Rust be true or not, the facts which he places at the disposal of our readers are of sufficient value to attract attention, and his construction of a large thermo-pile embodying the application of these facts, together with the results obtained, shows that he has not labored entirely in vain. While the activity in other, at present more promising or "practical," fields of electrical work have for some time put the thermopile in the background, its availability, though well defined, is still open to investigation, and recent developments would indicate that its merits are being recognized by not a few workers in this neglected field.

The New York Exposition of 1892. SOME three or four weeks ago, when we spoke of the Paris Exposition as affording many hints for the proposed exposition in this city in 1892, it was not quite a settled fact that an exposition would be held here. We are gratified to see that events have moved so rapidly as to insure not only the choice of New York for the exposition, but the gathering together of an unparalleled display of the triumphs of art and science. It will be recalled that, directing attention to the large attendance at Paris, we pointed out how greatly this was due to the opening of the exhibition at night, and the lighting by means of electricity. The New York exposition must similarly be kept open at night, and must also depend for its illumination upon electricity. This work alone will require a splendid equipment and exhibit of electrical apparatus, and it may, although it is still early to discuss such matters, be taken for granted that the electrical exhibit as a whole will be one of the most extensive and striking made. Electrical engineers should give all possible support to the undertaking.

Calelectric Generators. As remarked elsewhere on this page, the conversion of heat directly into electrical energy is receiving attention in various quarters, and work begun in one direction in this field rapidly branches out into others. This is well shown in the experiments of Mr. E. G. Acheson, detailed in another column. These, begun a few years ago, started with the application of heat directly to a conductor carrying a current, by which the electric effect was increased. Carrying this principle still further, Mr. Acheson has now applied it to the alternating current, and curiously enough claims to obtain an increase of efficiency by the application of heat to the core of the converter. Such an application would, on its face, seem to decrease the efficiency of the converter by the decrease in magnetic strength of the core due to the increase of temperature, but the results of Mr. Acheson being at variance with this supposition, they would indicate that there is much still to be determined regarding the action of heat in the converter. But going still further, Mr. Acheson applies the same principles in another way to the increase of the efficiency of the thermopile. In the lack of quantitative results, the scope of these new applications cannot be defined, but they will not fail to excite interest by their novelty and possible utility.

Heating of Converters. A QUERY of one of our correspondents raises the interesting question of the heating powers of a converter, or rather of the extent to which the iron in a converter can become heated. It would seem on the first consideration that with sufficiently powerful current and by giving the iron a heavy duty to perform due to intense magnetization, the heat engendered in it might be sufficient to ultimately cause its heating to redness, leaving out of consideration the question of safety catches, etc. But upon further consideration it would seem that although the converter might be heated to a considerable degree by such means, its heating to the point of redness is problematic. This is owing to the well-known properties of iron, by which it loses its magnetism in the neighborhood of red heat, and even before that point is reached it is perceptibly weakened in magnetic strength. Hence, with a core practically inert, the generating power of the coil would be reduced to that due to the interaction of the coils alone, independent of the core, which would evidently be but a very small amount, entirely insufficient to maintain the core at a high temperature. The question is a very interesting one, not only from a scientific, but also from a practical, point of view, and we would be glad to record the opinions of others on the point involved.

Central Station Combinations. THE relations which the central station for the distribution of electricity bears to the consumer would appear to have been fairly well defined up to the present time, but new and exceedingly valuable features, showing the wonderful scope which can be given to electrical distribution, are cropping up every day, and their end it is hard to foresee. The functions of the central station as a source of light and power are well known, but the combinations which can be effected between it and isolated plants are well pointed out in two articles appearing in this issue. Thus we find that in Boston a number of isolated plants are connected with the central station conductors, so that failure on the part of the plants will not result in the extinction of the light. But we would draw particular attention to the proposition now being considered, of an isolated plant which is to be so connected with the central station conductors, that at a moment's notice the dynamos now employed for lighting may be converted into motors to drive the printing presses of a large daily newspaper. Here is a combination which is truly unique, and shows not only the sagacity of the owners of the plant, but demonstrates again the wonderful adaptability or flexibility of the electric current. In Detroit also we find a large factory equipped with electric power generated on the premises for Eddy motors, so arranged that it also may derive its energy from the central station, but on the other hand, should the central station be driven to its full capacity, this isolated plant may assist it during a temporary overload.

NEW BOOKS.

Standard Tables for Incandescent Wiring. Compiled by Ch. M. Davis. 3½ × 5 inches. 47 pp. Price, 75 cents.

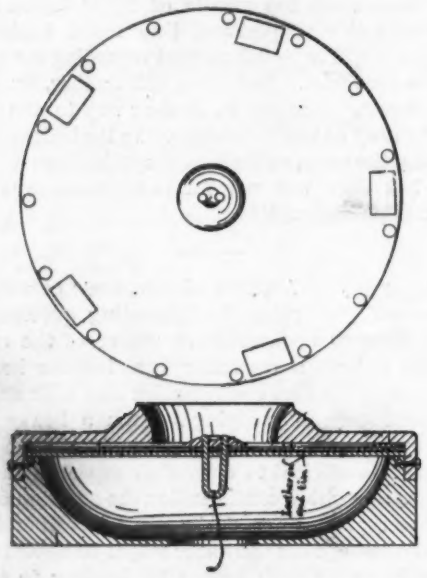
This little work is designed specially as a *vade mecum* for those engaged in wiring for the incandescent light, but contains also much that is valuable for those engaged in electric distribution work generally. The book gives tables and rules for ascertaining the size of wires for the Thomson-Houston, Westinghouse and Edison systems, so that those intrusted with such work may be guided intelligently.

Besides these tables, the book contains the rules of the New York Board of Fire Underwriters and the New England Insurance Exchange, together with a number of valuable hints on the care of dynamos, lamps and station apparatus generally. Copies can be obtained at this office.

The Thomas Mechanical Telephone.

The use of private line telephones is growing from day to day, and where the expense attached to the electrical telephone is prohibitive, the mechanical telephone in many cases affords an excellent substitute. In order to meet the requirements of a successful instrument, Mr. George Thomas, of this city, has recently brought out an apparatus, which we illustrate in the accompanying engravings. Fig. 1 shows a section and Fig. 2 a front view of the diaphragm employed. This is constructed of a combination of leatheroid and tin, possessing high resonant qualities and giving clear enunciation.

When properly erected, the instrument will, it is claimed, work satisfactorily over a distance of two miles, and at a distance of one-half mile gives excellent results. The instrument usually has a magneto-call attached, but for



Figs. 1 and 2.—The Thomas Acoustic Telephone.

short distances a few cells of battery suffice to actuate a call bell at the other end.

We may add that a set of these instruments connects our offices in the *Times* Building with our stock rooms in the Tract Society building on the opposide side of the street, and that it is in constant use for the transaction of a large amount of business.

Ground Detector Indications.

To the Editors of The Electrical World:

Mr. Jenks, in his very complete paper on the Edison 3-wire system, states that the ground detector gives something like twenty-five different indications. Won't you please invite Mr. Jenks to explain its workings in detail? I am sure it would interest many of your readers who are not "electricians," like Mr. Edison, but who still have more or less to do with the subject. The men who put up our switchboard didn't appear to know any more about the ground detector than we did. J. L. Jamison.

Mount Holly, N. J.

Construction of Armatures and Painting Field Magnets.

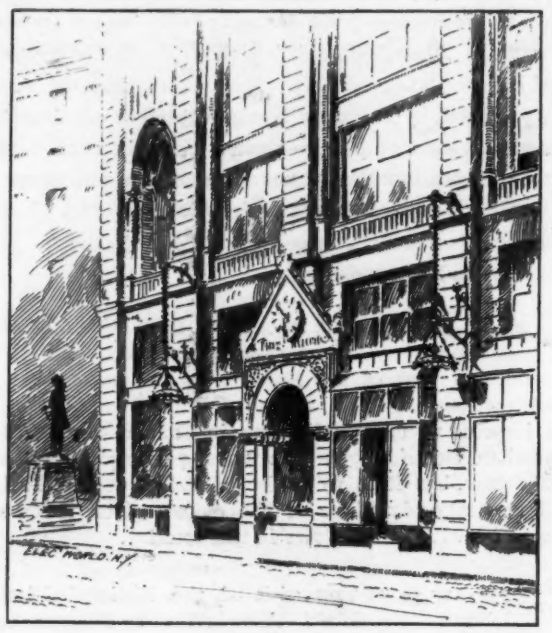
To the Editors of The Electrical World:

Will you please answer the following questions in your columns: 1. What kind of glue, or what is used on the armature of a Brush machine? I take the Brush machine as a sample to explain my meaning, as the coils project from the armature without any support. 2. What kind of paint is used on the field coils? A.

Answer.—Our correspondent seems to labor under a misapprehension as to the manner in which the Brush armature is constructed. The coils are not glued on, but are supported by the iron core around which they are wound in this machine, similar to those of the Gramme ring type, no glue being used. 2. Various paints are employed for this purpose, but a good asphalt or other insulating paint is to be preferred to a metallic paint.—Eds. E. W.

Lighting the Entrance to the "Times" Building.

Resort is generally had to the arc light for illuminating the exterior of or entrances to large buildings. Where incandescent lamps have been employed, they have generally been placed inside large lanterns, and the effect produced has been meagre and unsatisfactory. A new departure has been made by the New York *Times* in lighting up the outside of its building along Park Row, City Hall Square and



Lighting the Outside of the "Times" Building.

Nassau street. Our illustration shows the method adopted. Long bronze standards have been secured to the walls all around the building, extending downward from the second to the first story, and carrying at the bottom, under a large canopy, a cluster of six United States incandescent lamps, run from the fine plant in the basement. These standards, which are about 12 feet in length, are highly ornamental, and harmonize with the architecture in a very pleasing manner. Our picture shows two of them, one on either side of the clock doorway opening on Park Row, through which access is gained to the offices of The Electrical World. On the City Hall front the lamps shed a soft light on the bronze statue of Franklin.

McCreary's Combined Incandescent Shade and Reflector.

The ordinary form of reflector employed for incandescent lamps, though useful in its way, labors under the disadvantage that it leaves the space back of the lamp in

The New McCreary Incandescent Reflector.

comparative darkness. While this is not objectionable in some situations, it is a drawback in others, and may mar the effect which could otherwise be obtained. In order to avoid this difficulty, Mr. A. A. McCreary, of this city, has recently brought out the combined shade and reflector shown in the accompanying engraving. It is, practically, a modification of his well-known shade now in use so generally. This shade consists of an opal glass bulb, with its lower half removed, surrounding the lamp. It thus combines the properties of a shade and a reflector without throwing the deep shadows noted above. The shade can be attached to any lamp, or made of colored glass for decorative purposes, and is quite ornamental.

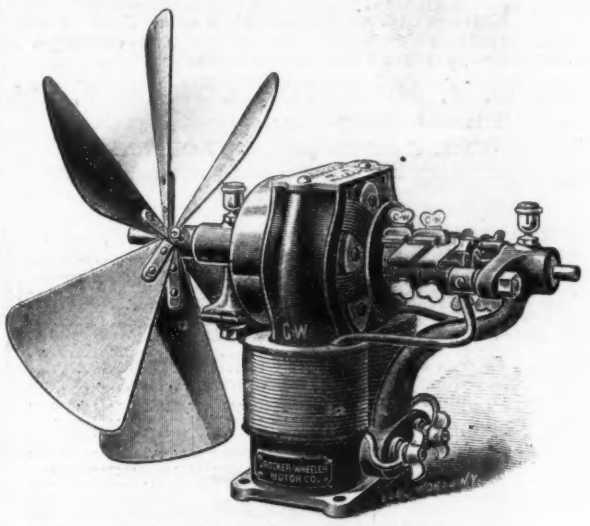
Death of George S. Ladd.

It is with much regret that we record the death, in London, England, of Mr. George S. Ladd, on July 29. He had been in England only a few weeks, and was contemplating an extended trip when he was seized by his fatal malady.

Mr. Ladd was born in New England of English parents, whom he accompanied to the Pacific slope shortly after the gold fever broke out. His father died soon after the family arrived there, and they fell into very straitened circumstances. When about fifteen years old he was employed as a messenger by the Western Union (then the Pacific) Telegraph Company of that division, and learned to receive and send messages between times. He was subsequently promoted to be an operator and then a division superintendent. All the while his pleasant ways and strict attention to duties made him generally liked among the wealthy men with whom he came into contact, and when the telephone began to be talked about as a means of communication he was one of the first to appreciate its advantages. As soon as possible he organized the Pacific Bell Telephone Company, and became its president. He founded also the American District Telegraph Company of San Francisco and was its president. He was the head of the Sunset Telephone and Telegraph Company, the Pacific Electric Storage Company, the Pacific Edison Electric Light Company, the Electric Development Company and the Gold and Stock Telegraph Company, which operates the stock tickers of San Francisco. Mr. Ladd was a member and officer of the Union Club of San Francisco, and was, with his wife, widely known and admired by society in that city. He leaves a widow and one child. His fortune is said to have been nearly $3,000,000. His body will be taken to San Francisco for interment.

New Crocker-Wheeler Fan Motor.

In the excellent paper read by Mr. F. B. Crocker at the last annual meeting of the American Institute of Electrical



The Crocker-Wheeler Motor.

Engineers, on "Electric Motor Regulation,"* he alluded to a method devised by himself, in conjunction with Dr. S. S. Wheeler. In this machine, it will be remembered, the arrangement is such that the armature can be slid away from the field magnets so as to decrease the magnetic field influencing it in proportion to the work done by the motor. Motors of this type of automatic regulation are now being constructed by the Crocker-Wheeler Motor Company, of this city, and our illustration shows the smallest size, ¼ h. p., in combination with a fan.

It will be noted that the armature is wound with three coils on a toothed core of laminated iron. Mounted on the same shaft alongside is a cylinder of iron of the same diameter as the armature. Normally when the motor is working at full power, the iron cylinder is entirely removed from the influence of the field magnets; but when it is desired to slow down the speed of the machine, a simple device slides the shaft longitudinally in the bearings so as to bring the iron cylinder between the field magnets, which movement at the same time shifts the armature away from the field magnets. By displacing the shaft more or less in this manner any desired speed can be obtained.

In the large motors now in course of construction the regulation is effected automatically by means of a governor attached to the shaft, which keeps the speed constant at all loads.

Electric Motor Power for Western Mines.

Contracts have recently been signed for an extensive power plant to be placed in one of the great mines in the iron range of the Northwest, the Ashland at Ironwood, the installation and operation of which will be watched with eager interest by all the mining engineers throughout that section, as, conditional on its proving a success, further contracts have been placed for electric motor power, amounting in the aggregate to over 5,000 h. p. The system to be adopted is the Thomson-Houston, and the entire work will be in charge of Frederick N. Bosson, of the Chicago office. The most important feature of this installa-

*See The Electrical World, June 1, 1889.

tion, and one showing most conclusively how strong is the faith of intelligent engineers in the grand future of electric power plants, is the fact that all steam and compressed air devices will be displaced and electric motors only operated. Various sized motors ranging from 7½ h. p. to 60 h. p. will be employed in the different work required. Cameron or Dean pumps will be used, and the hoists will be set up by an Akron firm. A second feature of importance is the fact that a current of low voltage will be used, necessitating large copper conductors and adding considerably to the cost of installation. This is done in consequence of the liability of "grounds" occurring on the circuit and to avoid the slightest possibility of danger to the miners should they come in contact with a conductor when grounded. This action indicates wise forethought on the part of the electrical engineer and generosity on the side of the mine owners. Eighty per cent. efficiency has been guaranteed.

A Novel Plan for Driving Dynamos by Water-Power.

BY L. H. HALLAM.

In a recent issue of THE ELECTRICAL WORLD I saw an account of a system to utilize the power of the Niagara River. As it was interesting to many, some of your readers may be interested in a description of a machine that I have originated for that purpose. The machine is placed in the direct current, and is entirely under water except the top of the tower, which extends above high-water mark. All parts are so constructed that no drifts, ice floats, etc., can become lodged or interfere with its action in any way. It consists of an iron or steel tower, 20 × 20 feet, and high enough to reach above high-water mark when placed on the bed of the river.

On the up stream side of the tower, at its base, there is placed a room with its end joined to the tower and opening into it. It is the width of the tower, 10 feet high, 30 feet long, coming to a point like the prow of a boat. From this point, to the high-water line on the tower, there is built a frame work with its edge to the current to form a cut-water, throwing the direct force of the current on each side of the tower. This frame-work also acts as bracing, holding the tower and room in one rigid mass. The tower and room are built water-tight, but the space above the room, enclosed in the frame-work, need not be so. In the base of the tower, there is built a water-tight compartment 13 feet square, with one side opening through the side of the tower on its down stream side. Through this 13 × 13 foot side it is filled with water; but as it is separated by water-tight walls from the rest of the tower the water goes no urther.

In this room is placed a drum 12 feet in diameter and 12 feet long, with six sides. This drum is on a shaft which extends through the walls of the room into the tower. The shaft revolves in a water-tight boxing, placed in the walls of the compartment and tower. It is geared to shafting running into the 30-foot room. On this drum hangs an endless steel belt 12 feet wide and 200 feet long (or any length desired). This belt is composed of plates of steel 12 feet wide (width of belt) and 6 feet long. These plates are connected together with an ordinary hinge joint. The hinges are so made that the flat or smooth side will be on the inside of the belt so that it may rub freely together. At each joint there is hinged a 12 × 6 foot plate of steel, which acts as a paddle. It is chained to the joint back of it, in such a manner that when the side of the belt it is on is going down stream, it is presented to the current and adds its force to the rotation of the belt. But when it passes the lower end and starts back, the force of the current closes it down flat on the belt. Consequently, it catches no current till it passes up and over the upper drum and starts down stream again on the lower side. Hanging in the lower end of the belt is a loose drum the same size of the upper one. It and its supporting framework are hollow, and have floating power enough to float the belt clear of the bed of the stream. It also keeps the belt tight, and is so constructed that it will not allow the belt to turn over or become tangled. The paddles being also arranged so that they will be presented to the current when on the under side of the belt, tend to raise and keep it clear of the bottom. The power thus obtained from the stream is transferred through the belt, drum and shafting to dynamos situated in the 30-foot room. From these it is carried to the desired point by an electric current, passing over wires connected to the shore from the top of the tower. Of course there are various points about this machine that are necessary to its proper working that I have not mentioned. I have only attempted a general description. The tower and dynamo room should have sufficient weight to sink and stand firm on the bottom. Heavy cables should extend from the prow and different parts to each shore, being securely fastened to prevent the heavy pull of belt from dragging it down stream.

I need not say it is possible to place dynamos in this kind of a place, when it is remembered that the Brush Company have successfully placed several in the Comstock mines of Nevada. They work there under as many disadvantages as would dynamos under circumstances I have mentioned. In fact, the tower and dynamo room can be so constructed and ventilated that the machinery would be placed under no more disadvantages than if it were in some basement. There should be a stairway leading from the top of the tower down to the dynamo room. Communication may be had with the plant from the shore by means of boat or otherwise. I would be glad to see what others think of this method of using the immense power of the Niagara River.

The Boston Edison Stations.

It was not long after the success of the Edison station in New York was demonstrated that plans were laid for the construction of a similar station in Boston, but on account of various delays actual work was not begun until 1885, and it was not until nearly a year later that the current was actually switched on the system. From the very start the growth of the business has been a steady one, so that soon after the completion of the first station the construction of a second was begun, which is now in full working order, supplying a large district. Both these stations are built on the same plan and differ only in minor details, so that a description of Station No. 1 will suffice for both.

Beginning with the engine room, we find it to be, like the rest of the building, absolutely fire-proof. There is not one inch of wood used except on the window frames. The floor is of concrete, the walls are of brick, and the ceiling is the usual fire-proof construction of brick arches and iron beams, heavy enough to hold the dynamos above. There are installed in this room nine 15½ × 15 inch Armington-Sims high speed automatic engines aggregating 1,350 h. p. The piping is arranged so that any joint can be taken apart or repaired without throwing out of service more than three engines.

It is from this room that the pipes radiate for steam heating. At the present time heat is being furnished to some 4,000 square feet of radiators in the adjoining building. This is, of course, only a beginning, but connections are so made to the live and exhaust steam pipes that live steam can be used if necessary; or, in lieu of that, exhaust steam so arranged that back pressure is only put on the engines when actually necessary to furnish the amount of heat required while the remaining engines are exhausting freely into the air. Hence, until the heating demand grows to such proportions that it will be necessary to install one of the numerous patent vacuum systems, the station is able to obtain the best results of exhaust steam without waste of power due to back pressure when it is not needed.

The boiler room is on a level with the engine room, and opens out from it. There are installed seven 125 h. p. return tubular boilers, set with Jarvis setting. The second story is also built and arranged for a duplicate set of these

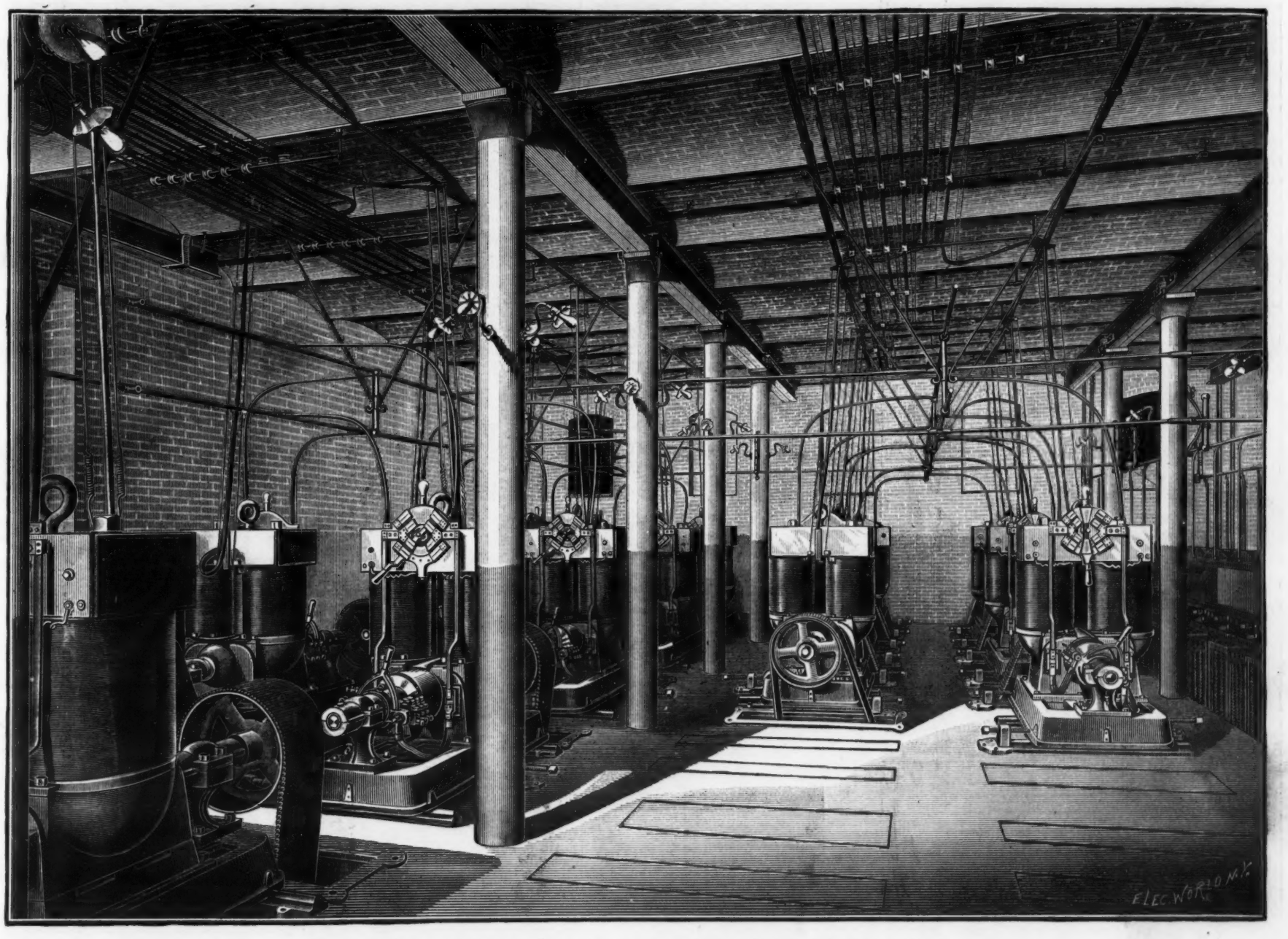


FIG. 1.—DYNAMO ROOM, THE NO. 1. EDISON STATION, BOSTON, MASS.

boilers, making the rated capacity of the entire boiler plant 1,750 h. p., which can easily be forced to 2,450 h. p., or 175 h. p. per boiler. Two National feed-water heaters and two Davidson steam pumps complete the outfit.

Directly over the engine room is situated the dynamo room. This is the room that was damaged by fire one year ago. Since then it has been entirely refitted, so that to-day it has the lowest rating from the insurance companies of any manufactory in Boston. The accompanying engravings show two views of this room.

In the construction of this part of the station, slate, hard rubber and porcelain have been used instead of wood, and it is believed to be absolutely safe from fire. The floor is made of imported rock asphalt, laid over a bed of concrete, while the walls and ceilings are finished as in the other parts of the building.

The equipment at present consists of eighteen 125-volt 400-ampère Edison dynamos, with their accompanying ampère-meters, switches and resistance boxes. The bus-rods, as will be seen in Fig. 1, are suspended from the ceiling in a substantial manner. The cable running from each dynamo to the bus-rods is composed of a thousand small copper wires surrounding a ¼-inch steel rod, thus affording carrying capacity and at the same time being perfectly flexible and self-supporting. The middle or neutral wires are all carried to a common centre, and here are grouped the ampère-meters, switches and rheostats shown in the foreground in Fig. 2, giving complete control of the entire system within the reach of one man's hand.

In another group by themselves, shown in the background of Fig. 2, is the feeder apparatus, consisting of switches, ampère-meters, equalizers and potential indicators. By an ingenious switch-board, shown at the extreme right in Fig. 2, any combination of potential apparatus can be made and measurements of drop in equalizers, feeders, or any other part of the system can be quickly made.

During the growth of the business one-quarter of the dynamo and engine room has been partitioned off for offices. Even here wood has been used only for the window sashes, all other construction being of brick or glass.

In the part cut off from the engine room is a complete meter room. Here all the Edison meters used in the city are brought together. There are in use on the circuits at the present time over one thousand Edison chemical meters. There are also numerous isolated plants in the city whose owners are supplying light to their tenants or neighbors through meters installed and cared for by this company. As many of the large customers, especially the theatres, require weekly bills, the number of meter changes during the coming winter will probably amount to 1,500 per month, which will be very easily taken care of from the First District meter room.

The outside street construction is so arranged that in case of emergency one station can assist the other very materially. In all the principal streets the regular Edison three-wire underground tubing is used, while in some of the outlying streets, where the growth of the business at present prices was problematical, temporary overhead construction has been used. This is gradually being replaced by an underground system wherever the business has demanded it.

There are at the present time connected and actually running from the two Boston Edison stations 19,000 16 c. p. lamps, and 725 h. p. is furnished by electric motors. There are also isolated plants which derive part of their current, and frequently their entire current, from these stations. Another interesting fact is that at the present time there is pending from one of the largest newspaper offices in Boston a proposition to so arrange the electrical apparatus that their dynamos now driving 900 lights can be instantly turned into motors to drive their entire printing establishment, while the lights can be taken from the station. There are also being installed in the district covered by the Edison circuits isolated plants aggregating over 3,000 lights, which expect at certain times to take all their current from the station. Thus, reducing the motors to equivalent lamps, there is a total of over 35,000 16 c. p. lamps which will be connected to the two stations during the coming winter.

The station is equipped throughout with leather link belting, of the Ireson and Schieren makes, in about equal quantities. The dynamo room, it may be added, is lighted by brackets on the iron posts, the wires running inside the posts, each group having its own switch. Mr. C. L. Edgar is superintendent of the whole Edison system in Boston, and he has had the satisfaction of seeing his management eminently successful.

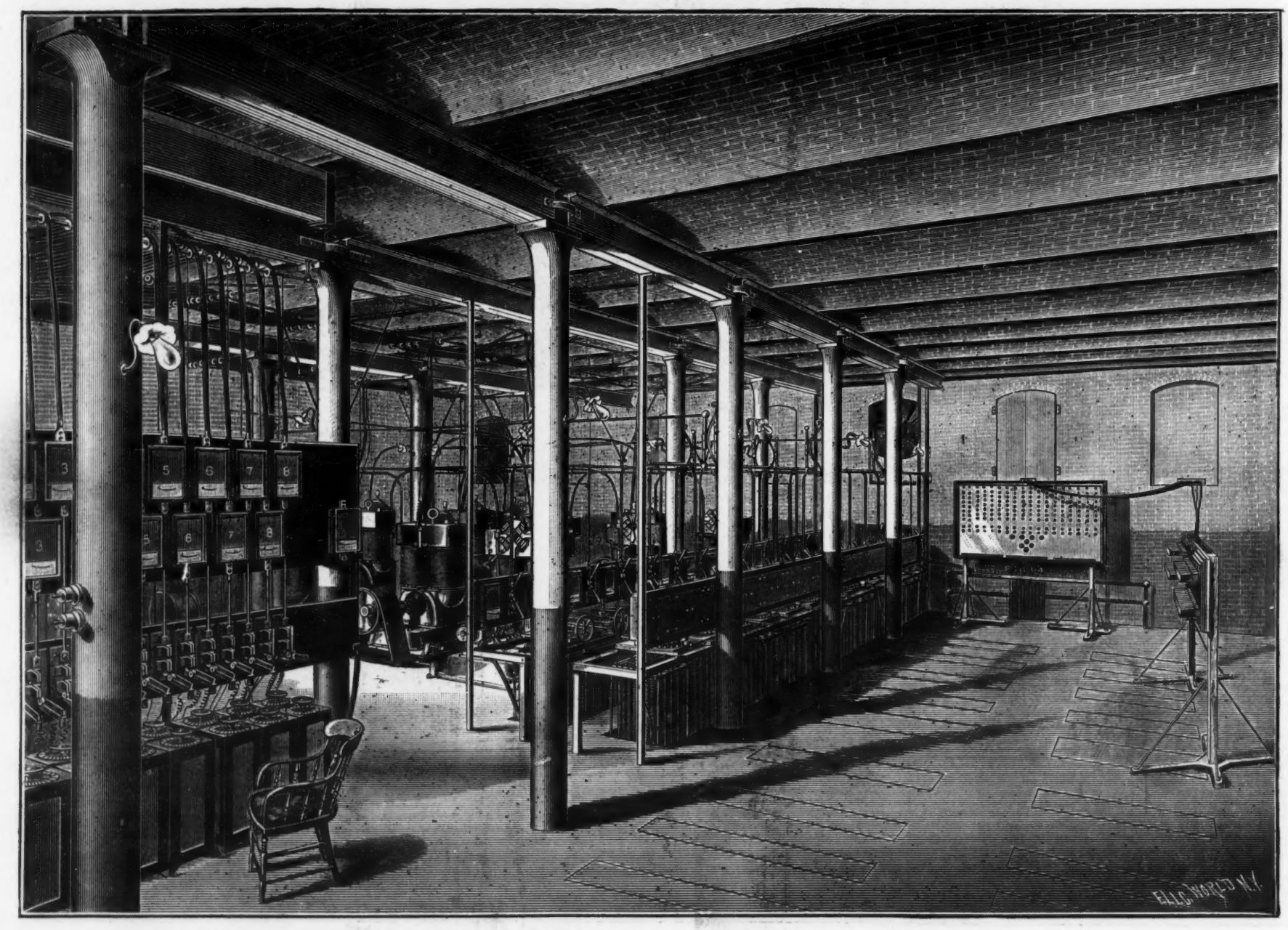


FIG. 2.—REQULATINQ APPARATUS, NO. 1. EDISON STATION, BOSTON, MASS.

Inspecting Electric Light Plants.

To the Editors of The Electrical World:

I noticed particularly in your issue of July 13 the second article on inspecting electric light plants, and from my own experience think it necessary that something should be done; for not only is electrical apparatus in danger, but also the people working the same, and all concerned. According to the report of Mr. H. P. Brown, we find that at least fifty of the sixty-four killed by arc light currents could have been saved by proper insulation, etc. And from personal experience I could give several statements such as Mr. Watts mentioned in his article. One in particular, the superintendent of a plant in a Pennsylvania town, to whom I spoke of the insurance laws and rules of the board of fire underwriters, said: "We don't care for fire underwriters or anyone else; we run this town ourselves." There are others I might mention, but fear they would take up too much room in your valuable paper.

I also wish to endorse the suggestion of Mr. Fred De Land, and think the insurance people would combine with the parent companies in this matter for their own safety, and not insure such places until a satisfactory report from the inspector had been received.

That would make the inspector's word law. C. E. B.

BROOKLYN, L. I.

The Use of Red Lead in Storage Batteries.

To the Editors of The Electrical World:

In a recent number of THE ELECTRICAL WORLD you seem to think that red lead cannot be used in batteries without infringing patents. Some special ways of using or applying it may be patented, but the article itself used in a galvanic battery is by no means a late invention. I experimented with red lead litharge thirty years ago and upward. Much information on the use of red lead will be found in the Smithsonian Institute Report for 1855 (Washington, D. C.), including Schönbein's experiments with that article.

While on the subject of batteries will you allow me to ask: What is the difference between any primary battery and a storage or secondary battery? That is to say, what produces the E. M. F. or electrical movement between the electrodes in the first instance, and how is the action or so-called "current" maintained? In my judgment there is no difference. The electricity is produced by the contact of dissimilar materials and the current by chemical reaction in both cases.

I have seen the quotation from Judge Coxe, as given by Mr. Preece in the WORLD, and as given it is, I submit, misleading and contrary to the facts.

The so-called storage or secondary battery is simply, as Mr. Preece says, a primary battery, and the action and reaction is therefore what I have stated above.

I write in good faith, and if wrong will be thankful to any one who will set me right. DAVID FLANERY.

MEMPHIS, Tenn.

Electric Power in the Globe Tobacco Company's Works at Detroit, Mich.

The enormous benefits secured in subdividing power and avoiding thereby the use of shafting are being gradually recognized, and factory owners are accordingly looking to the electric motor as the most available means for accomplishing this object. We have already described several installations of this character, and in this issue we illustrate another excellent example of what can be done in this branch of the motor field.

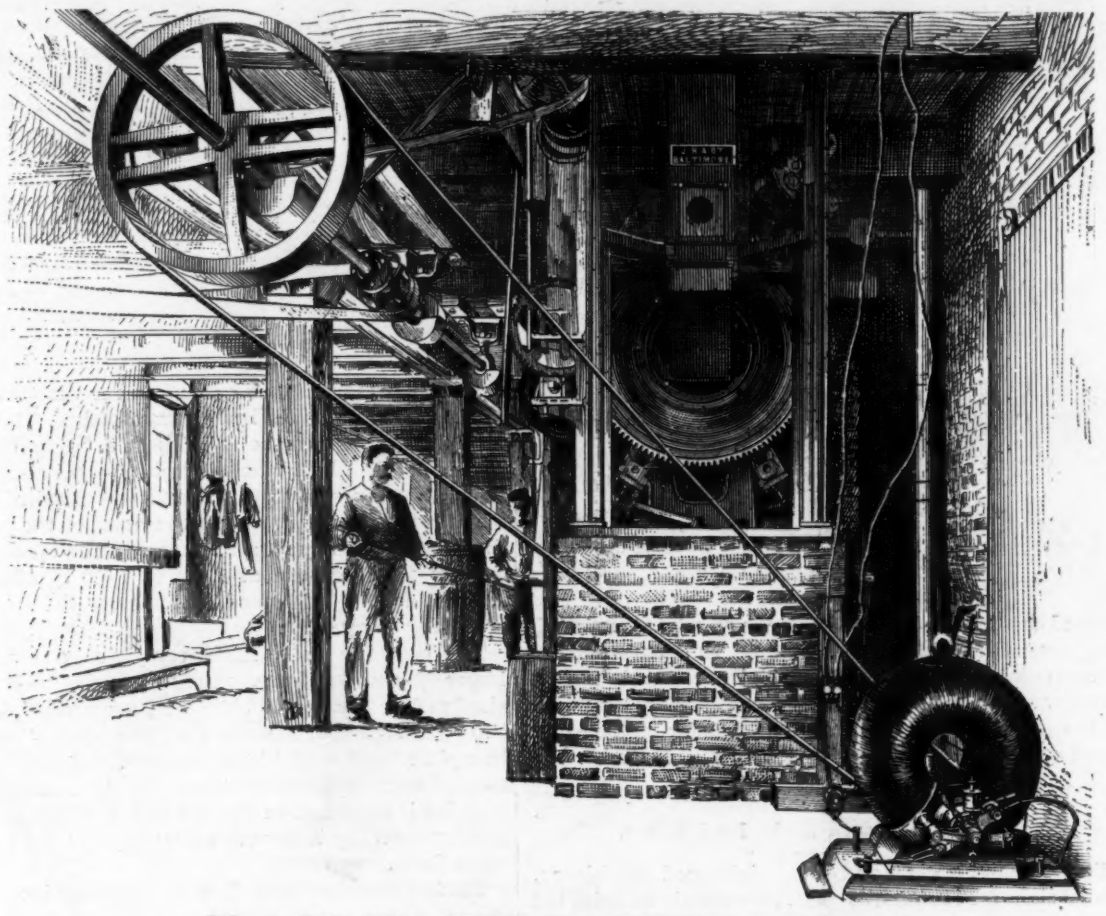


FIG. 1.—THE EDDY MOTOR IN A TOBACCO FACTORY.

The plant just installed in the factory of the Globe Tobacco Company at Detroit, was designed as a substitute for the long lines of shafting and connecting belts through the floors, that would have been necessary for the distribution of power from the engine in the basement to the machinery through the seven-story building.

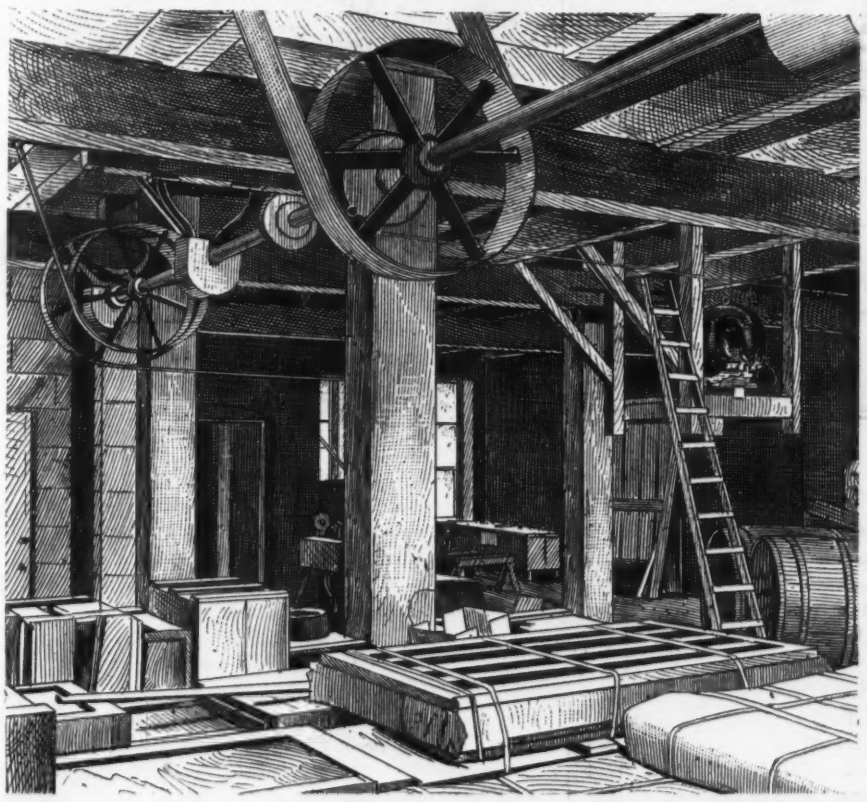
The installation consists of an Edison dynamo of 50,000 watts capacity, delivering current at 225 volts pressure at normal speed. A dynamo with a capacity much in excess of the present needs of the factory was selected, in order to meet future demands in this or neighboring factories.

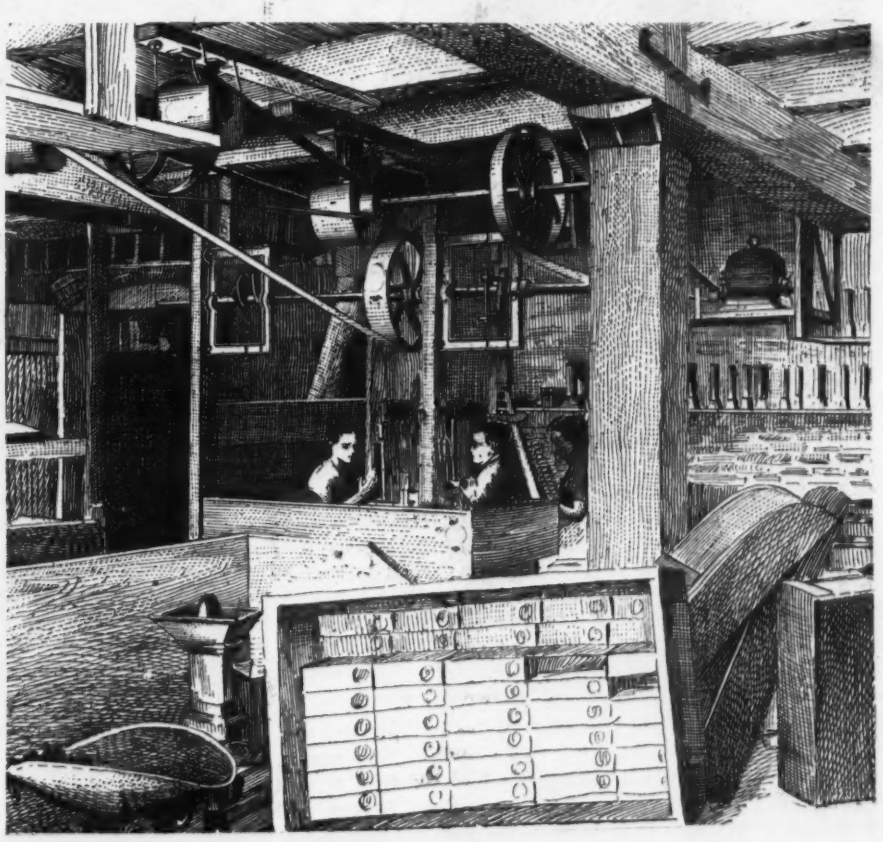
The current is at present furnished for seven Eddy electric motors in different parts of the building, of from 1 h. p. to 15 h. p. capacity, each driving its own machinery entirely independent of all the rest. These seven motors aggregate 42 h. p., and are nearly all working up to their full capacity, but, owing to the intermittent character of the work, the total current drawn from the dynamo never exceeds 20 h. p., and averages very much less. The manager of this company estimated from former experience, that it would require about 20 h. p. to drive the shafting that would be necessary to connect the machinery now driven directly by the motors, with the engine in the building. As this would have been a constant consumption of power, whether the machines were at work or idle, the results obtained are, in comparison, very satisfactory.

The dynamo also furnishes current for lighting the building, the lamps being wired two in series. The dynamo switch board is connected by underground mains with the station of the Edison Illuminating Company, and the entire factory can be run with the current from that station; or the factory dynamo can be used to assist the central station dynamos, in this district, during the months when the lighting exceeds the heavy motor load now carried by this station.

The motors as shown in the accompanying illustrations are with the one exception on platforms hung from the ceiling, thus occupying no floor space.

This plant was planned and installed by the Edison Illuminating Company, of Detroit, through their manager, Mr. C. P. Gilbert, and it represents a highly successful application of electric distribution of power in factory work. The Eddy motor was selected after a careful examination of its merits, and the results so far have shown the selection to be a good one.





FIGS. 2 AND 3.—THE EDDY MOTOR IN A TOBACCO FACTORY, DETROIT, MICH.

The Constitution of the National Electric Light Association.

To the Editors of The Electrical World:

In your issue of June 8 appeared extracts from a letter written by a "supply man" to an officer of the National Electric Light Association, on the subject of the relations of the supply men to the association. The ideas expressed so fully met with my approval, that I had intended ere this to have written you, generally supporting them. The rapid approach of the date of the next convention brings to mind the hot discussion which occurred at Chicago upon the report of the committee on underground conduits and conductors, and the friction which was engendered between a section of the supply men and the electric light men, proper. At the time, I thought it very unfortunate for the association, in many ways, that the proceedings took such a turn; but now looking back, six months having elapsed for due consideration of the matter, I cannot but think that what then seemed to me *unfortunate* was perhaps the most *fortunate* thing that could have occurred. It brought fully to the notice of the association the fact that if it was not already divided against itself, there was imminent danger of its being so in the near future, unless some amendment to the constitution was made. It clearly demonstrated that the so-called supply men took one view of the rights and privileges of their membership in the association, while the electric men took another entirely at variance with them. Representing, as I do, the interests in the Eastern and New England States of a Western manufacturing works, I place myself in the category of "supply men," among whom I have many warm friends. I cannot, however, coincide with the views of a number of them, as expressed at Chicago. I have always considered that, in allowing the supply interest a membership in the association, the electric light men performed a most courteous act, and all they have ever asked in return for the privilege is that they shall be subject to a small annual tax in the shape of a subscription. Had the electric light men foreseen at the time of incorporation of the association that there was any possibility in the future of the supply men taking the position which quite a number of them did at the last convention, they would have thought very seriously as to the advisability of extending to them the privilege of membership in the association, or at all events have so protected themselves through the constitution as to place the supply men in the position of members without voice or voting power in the conventions. Have the supply men ever thought of the privilege which the electric light men have given them in admitting them to membership in the association? Have they ever looked at the matter from a pecuniary point of view? Do they not meet at these conventions the very men they desire to do business with, and have every facility afforded them, both by introduction and otherwise, to discuss the merits of their manufactures, thus saving oftentimes the necessity and great expense of sending travelers to very remote points from home on prospective business? Have they forgotten that it is largely owing to the incorporation of the National Electric Light Association, and the hard work of the electrical men, that electrical interests of all kinds have received such an impetus during the past few years, and that these same men have been greatly instrumental, directly and indirectly, in creating nearly all the manufacturers to-day of electrical supplies? Surely as supply men, we cannot afford to lose the good will of the electric light men because a clique of members in the association who are interested in

one particular branch of the supply business feel aggrieved at action taken by the association in regard to a matter which promised large, profitable returns, had they been able to secure the full endorsement of the association. It would seem that a repetition by supply men, of the Chicago tactics, and an attempt to coerce the electric light men into endorsement of anything which at the present time they cannot see their way clearly to adopt, will be sure to cause disintegration of the National Electric Light Association. Under the present constitution it is a very simple thing for an individual member to pass any resolution on the floor of the convention. All he requires to do is to have elected to membership as many of his friends as may be necessary to secure a majority vote on any motion he may make. I do not wish to insinuate that any member of the association would stoop so low to accomplish a purpose, but merely offer the suggestion as an illustration of what seems possible under the present laws governing the association.

For my part, I would be satisfied if supply men were disfranchised from voting altogether and made ineligible for office. If that is not done, then amend the constitution so that the electric light men will at all times be able to control their own convention. I feel confident that any motion to amend the constitution, as suggested, would receive sufficient support from the supply men to carry it.

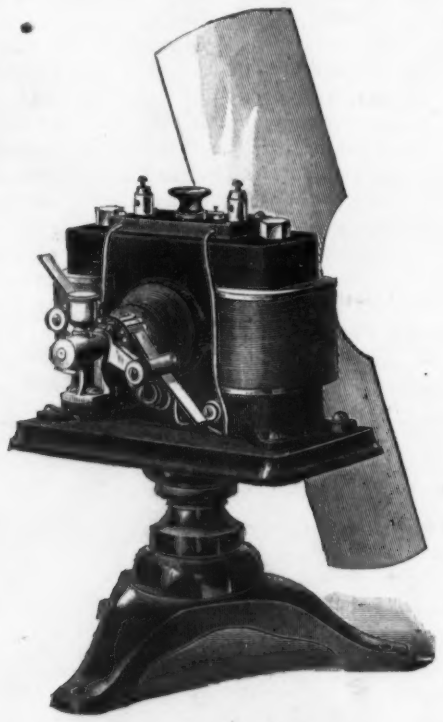
Walter C. Wonham.
Eastern Manager Hill Clutch Works.

New York City.

The Knapp Fan and Motor.

One of the most recent types of fan and motor outfits is that of the Knapp Electric Works, of Chicago, illustrated in the accompanying engraving.

The chief advantage of the fan lies in its having but two blades, which are struck from one piece of metal and presented so large a surface that an increased volume of air is kept in motion with small expenditure of power. The armature is of the cylindrical type, and the motor is wound for either constant current or constant potential circuits, as may be required. The tripod is of graceful design and made sufficiently heavy to prevent jarring when the fan is in motion, while screw holes are drilled through the feet in order that the apparatus may be attached to wall or ceiling at any desired angle.



Knapp's Motor and Fan Outfit.

The Warner Electric Light Gauge.

The Standard Electric Time Company, of New Haven, Conn., are now introducing their new electric light gauge, which they have had a great inquiry for since it was exhibited at the Electric Light Conventions in Boston and Pittsburgh. It has now been completed and thoroughly tested, and will no doubt meet with a large sale. There are many advantages in using this gauge in central electric light stations. It has a large and clear dial about 6 inches in diameter, and can be seen at a long distance. It is "dead beat," and known as a zero gauge.

When the long pointer stands perpendicular, or at 0, the current is normal, for any current to which the gauge may be set, from 1 to 50 ampères. The figures "Above" and "Below" denote the number of ampères above or below the normal. The gauge shown in the cut is set for a normal current of 10 ampères, and 1 above would be 11 ampères or 1 below would represent 9 ampères. The pointer shown in the opening in the dial indicates the direction the current is flowing, and will point toward the negative binding post while it will make no difference with the long pointer in which direction the current flows.

The gauge is also furnished with an alarm attachment which will ring the bell shown at any desired variation of the current above or below the normal point. This is of great advantage to any one operating an electric light plant, as attention is immediately called when anything is wrong.

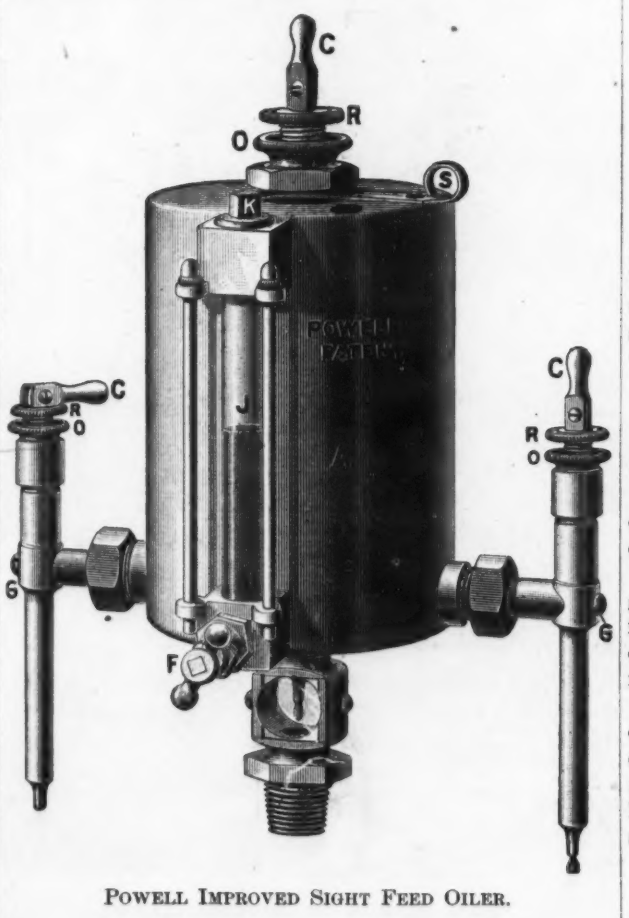
A smaller size of this guage is made for fire alarm circuits, and the zero or normal point is set to compare with the standard 30 used by the Gamewell Fire Alarm Telegraph Company. When the current drops to a certain point or the line is broken, the alarm bell will ring until

Warner's Arc Light Gauge.

stopped or attended to. There is quite an advantage in this gauge over the ordinary galvanometer, as it is not affected by any outside influence. The pointer comes to rest instantly and the reading is greatly multiplied. One degree on the galvanometer will vary the pointer on the gauge about one inch in space, making it very easy to read.

Powell's Improved Sight Feed Oilers.

For dynamos, engines and other high-speed machinery, special sight feed automatic oilers that permit of light, but constant and perfect lubrication under all circumstances, are now considered an absolute necessity. The William Powell Company, of Cincinnati, have brought out an oil cup which they claim has many points of superiority, it being so arranged that there can be no clogging of the tubes, while the sight can be inspected and cleaned or repaired without stopping the flow of oil or interfering with the running of the machinery. The mere raising or lowering of a snap lever starts or stops the flow of oil without changing the set of the feed.



Powell Improved Sight Feed Oiler.

The William Powell Company also manufacture a special triple sight feed oiler, shown in the accompanying engraving, and designed for use on the larger sizes of dynamos and engines, and made to contain any desired quantity of oil, from one quart to one or more gallons. The side arms on these triple oilers are adjustable, being made to fit any ordinary box or shaft, while the vertical tubes are made in all lengths up to 17 inches. These cups have been placed on a large number of dynamos and engines in this country, many electric light plants having been entirely equipped with them, while several orders have been received from foreign countries.

The "New Century" Dynamo.

Jewelers, silversmiths, nickel-platers and electrotypers have given rise to a demand for a small dynamo specially adapted to their needs, and as the gentlemen identified with the New Century Electric Company are to a large extent themselves users of such a machine, it was only natural that their experience in electro-plating should lead to the conception of a dynamo suited to their trade.

The dynamo shown in the illustration is a small shunt-wound machine, giving a potential of about four volts, and capable of delivering about fifteen ampères. The commutator is divided into four segments, which are insulated from one another with mica, from which very good results have been obtained.

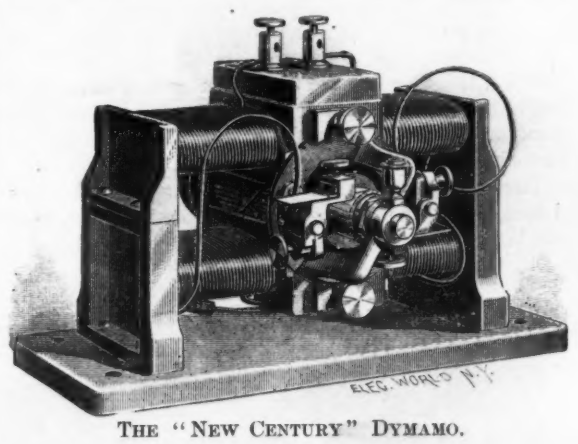
The armature consists of two double bobbins at right angles to each other, wound over bare, soft iron wire (soldered and painted) as a core. The two bobbins of each section of the armature are connected in series, the terminals of the coils leading to the middle of opposite segments, where they are secured by a screw attachment easy of access; no solder is used in making this connection.

One of the most novel features of the machine is the device for regulating the brush tension. The horizontal thumb screws shown in the illustration control the motion of a rocker arm to which the brushes are attached. The pressure upon the armature can be varied from a heavy one to no contact at all. Should the spiral springs against which the thumb screws press not pos ess sufficient amplitude of motion, the whole rocker arm can be rotated on the projecting shaft and secured by set screw in any desired position.

These machines run at 1,600 to 1,800 revolutions per minute, and at this speed there seems to be no liability of heating or sparking.

The company have lately completed a considerably larger dynamo for the same class of work. This machine also has four fields which, however, are vertical, the lower two being separated some distance from each other on the base plate to give additional strength and stability. Instead of using separate resistance coils, the rheostat of this machine is concealed in the top and is controlled in the usual manner by a thumb screw opposite the top of the upper fields.

The fact that the "New Century" dynamo is constructed by men themselves in the electro-plating business, to be used by themselves and furnished to silversmiths, electrotypers and others doing a similar class of work, has brought a special talent into play in the construction of this machine that will no doubt be appreciated by those who use it.



The "New Century" Dymamo.

Coal Consumption in Electric Light Plants.

To the Editors of The Electrical World:

In your issue of July 20 I note an inquiry regarding the consumption of coal necessary to run 200 arc and 1,000 16 c. p. incandescent lamps 12 hours per day.

I cannot answer the question exactly as it stands, but can give my own experience in operating a 1,000-light 16 c. p. incandescent plant. The lamps do not burn all night and on some nights not more than one-half are burning all night, the ampère-load running from 200 to 275.

The consumption on an average for a year is one ton of coal per day of 13 hours. We use "buckwheat" size of either Lykens Valley or other good steaming coal. I think my rate of consumption remarkably low and would like to hear of the experience of others operating under about the same conditions. W. E. S.

Middletown, Del.

We should be glad to hear from others on this subject.—Eds. E. W.

Sparks from Belts.

To the Editors of The Electrical World:

Would you kindly inform me through your columns if the following story is possible, and if so, have you ever heard of a like case? It is stated that an iron bar lying on a wooden shelf near a belt running at a high rate of speed became so charged with electricity that it sparked to some cotton waste, setting it on fire. "V."

Brookline, Mass.

Answer.—An iron bar resting on a perfectly dry shelf might have a charge induced on it from a neighboring belt which might result in a spark to a neighboring object. We have never heard of a case like the one mentioned, and should be slow to accept it as true.—Eds. E. W.

Electric Lighting in New York.

In our last issue we made mention of the appearance of an excellent article by Dr. S. S. Wheeler, in *Harper's Weekly* on "Electric Lighting in New York," and we drew attention to the great value of such articles as a means of educating the public to a proper appreciation of the position which electricity, and electric lighting in particular, now occupies as an industry. Mr. Wheeler's article gave a large amount of information on the various systems employed, their characteristics and methods of operation, and included also a good description of the overhead and new underground work now going on.

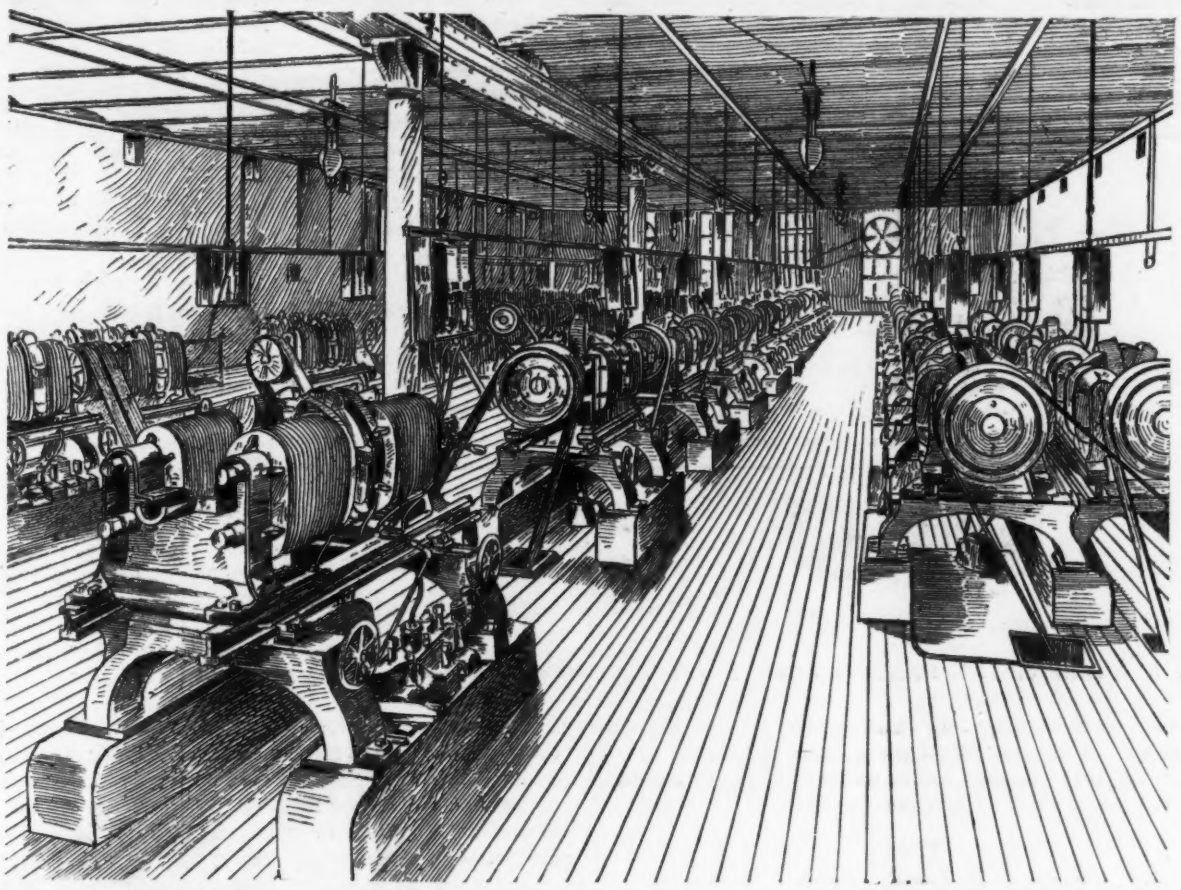


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FIG. 1.—THE BRUSH ELIZABETH STREET STATION, NEW YORK CITY.

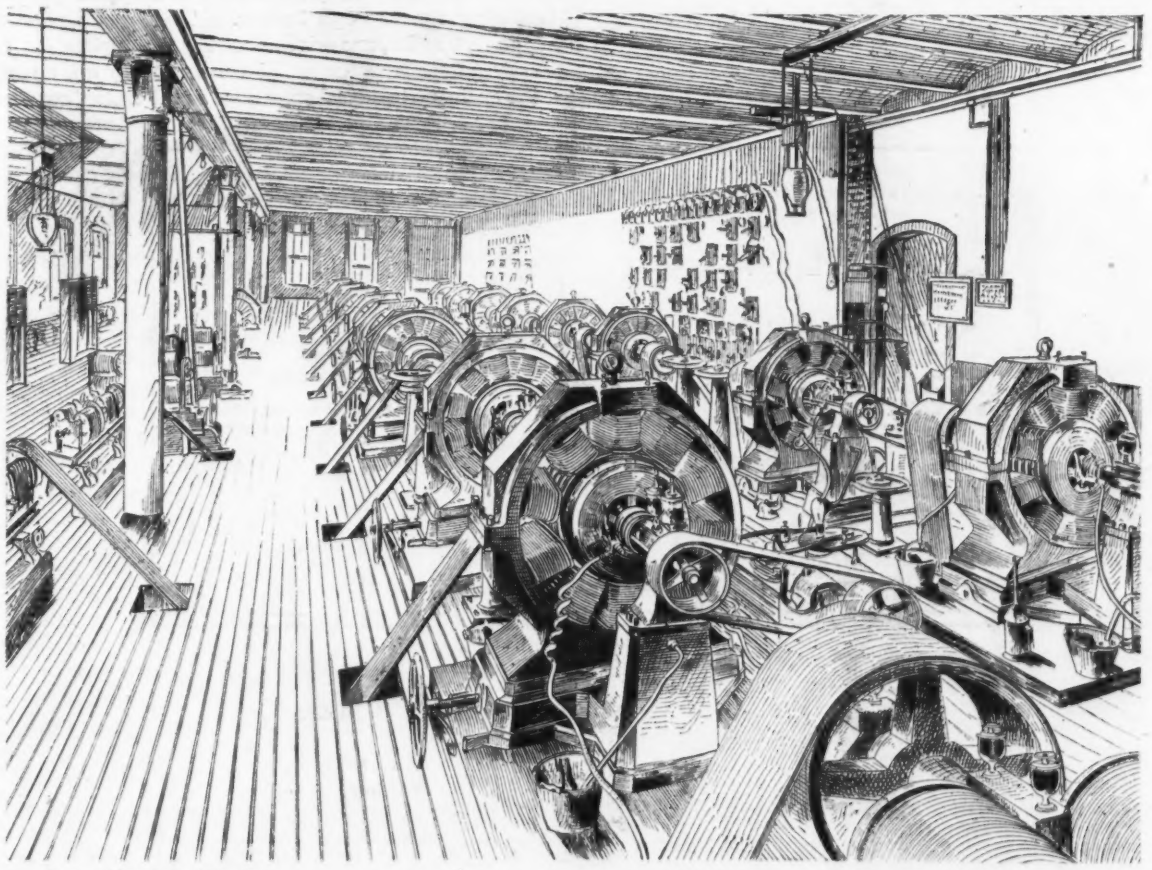
Through the courtesy of *Harper's Weekly* we are enabled to reproduce views of two central stations now in operation. That shown in Fig. 1 represents the dynamo room in the new station of the Brush Electric Light Company, at No. 210 Elizabeth street, at present one of the largest of its kind in the world. The machines are arranged in rows with sufficient space between for the passage of the attendants. Each machine is driven by a belt passing up through the floor from a shaft supported from the ceiling below, which is driven by the engines placed directly under it. The amount of current generated by each machine is adjusted automatically by regulators in small boxes suspended near by.

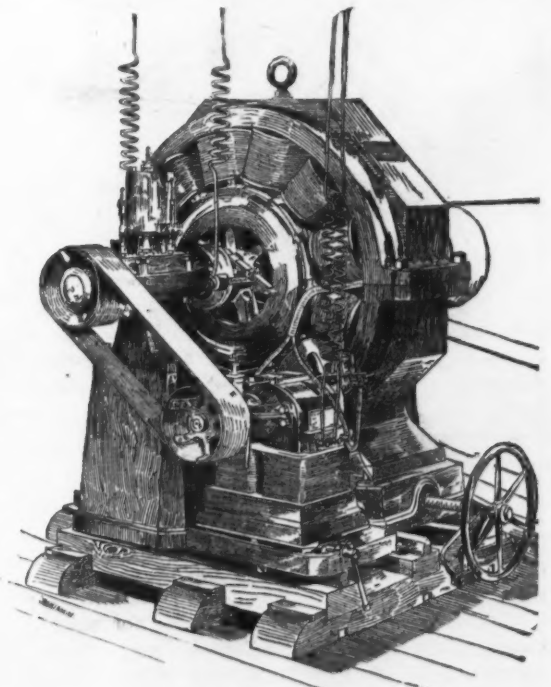
The two wires from each of the eighty machines in this station are laid under the floor in glass tubes imbedded in cement, and carried to suitable terminals on a large switchboard at the front of the building. From this point the wires are carried out of the building. The lights supplied by the company are classified, and placed on the appropriate circuits as follows: Those for street lighting, called "city lights," are connected on "city circuits;" those for lighting stores are on "commercial circuits;" and such as are needed in the daytime are supplied by "day circuits." On the wall by the switch is posted a list giving the precise hour and minute when each circuit is to be started and stopped for every day in the year, as regulated by the time of sunrise and sunset. At the required time the attendant connects the cables from the proper dynamos to the circuits to be lighted.

Referring to the distribution by alternating currents, Dr. Wheeler shows that in New York electric lights are supplied by alternating currents over wires six and eight miles long by the Manhattan Electric Light Company, who, by means of this system, are enabled to establish their generating station at a distance on the outskirts of the city, where the operating expenses are a minimum. The machinery used is that of the Slattery induction system. The station is on the East River at Eightieth street, where coal and supplies can be brought by barges at considerably less expense than if they had to be unloaded and carted across the city. The current is generated by a large number of dynamos, which are placed on strong foundations on the second floor of the building, and are driven by five powerful engines situated on the floor below.

The illustration, Fig. 2, gives a view of the dynamo room at the station, showing the arrangement of the machines. This building is the latest and one of the largest that has been put up for electric light purposes. It has a capacity nearly double that of any other station, having accommodations for engines of 5,000 horse-power, and dynamos for 70,000 lights. It was built upon the most approved plan, with the aid of the experience gained with former stations. It is fire-proof and very substantial, and is one of the best arranged stations in the city. The wires from each machine are led to switches placed on the wall, which can be seen in the background, and above these are meters which show constantly the amount of current being supplied over each wire.

Fig. 3 shows one of the dynamos and the method of connection with the exciter on the same base. All of the electricity generated here is carried down to the centre of the city by comparatively small wires over a well-built line of poles five miles long. From this line the wires are turned off at convenient points, and carried across town on other poles to the terminals of the subways, where they are connected to the corresponding cables underground, which in turn are connected by branches to numerous theatres and stores. A great many public places are lighted from these wires, the current which can be carried by each one of them, when transformed by the converters into currents of low pressure, being sufficient to light a large number of lamps.





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FIGS. 2 AND 3.—THE MANHATTAN COMPANY'S STATION, NEW YORK, AND THE FORT WAYNE SLATTERY DYNAMO.

An Electric Trumpet.

A trumpet producing its musical note by the vibration of a circular steel membrane by means of electricity has been invented by Captain Zigang, of the Thirtieth Infantry, in garrison at Domfront, Orne, France. The vibrator has a small, soft iron armature, which vibrates under the influence of an electro-magnet, with make and break at a platinum contact, and this, covered in by a copper resonator, produces a trumpet-like note. The strength of the sound can be varied by regulating the contact, and with several instruments connected by a commutator, a bugle-call or musical airs can be played. The electric trumpet is made by M. Basse-Crosse, Paris, and is supplied in four sizes.

A Hint for Pole Bracket Makers.

To the Editors of The Electrical World:

I wish to call the attention of your readers, and especially of the manufacturers of electrical supplies, to a single fault in electrical apparatus, which has for years given me much annoyance, and which I hope other users of supplies will join me in condemning, and thus forcing the manufacture of a better grade. I refer to the common pole bracket for glass insulators; as they are now made, the neck and threaded end are not cut far enough out from the face side where the bracket is joined to its support. This in nearly *every* instance allows the outside edge of the insulator to make contact with the bracket support, which in wet weather means *grounds*. Now, it is a shame that for so small a fault as the lack of ¼ of an inch more of material on the butt end or heel of the pole brackets thousands of electric lines all over the world should be suffering from ground troubles during every little wet spell; and I hope your readers and all practical electric light men will join me in a loud call for an improvement in this much neglected quarter.

WM. M. DAVIS.

Utilizing Niagara Falls.

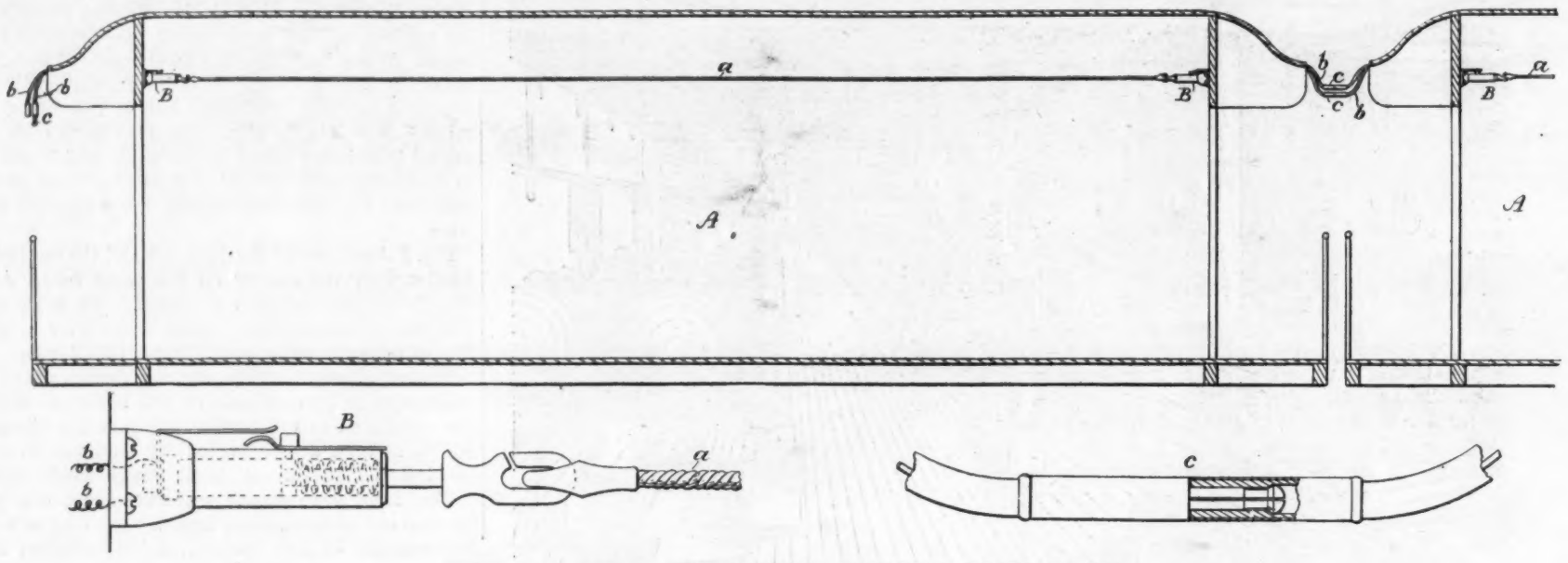
For many years the project of employing the vast power of Niagara for the driving of mills on the spot has been a subject of speculation on the part of engineers, and a variety of plans to accomplish this end have been proposed. More recently the great advances made in the electrical transmission of power have rekindled the interest taken in this subject, and it is not unlikely that the near future may see the partial utilization of this great store of energy now running to waste.

One of the most recent plans put forward with this end in view is that proposed by The Niagara River Hydraulic Tunnel, Power & Sewer Company. This company seeks to solve the problem by constructing a subterranean tunnel from the water level below the Falls, about 200 feet under the high bank of the river, extending through the rock to the upper Niagara River at a point about one mile above the Falls, where a head of 120 feet is obtained. The tunnel thence extends parallel with the shore of the river one and one-half miles at an average depth of 100 feet below the surface of the earth, and at a distance of about 400 feet from the navigable waters of the river, with which it is connected by means of conduits or lateral tunnels, as shown by the accompanying maps.

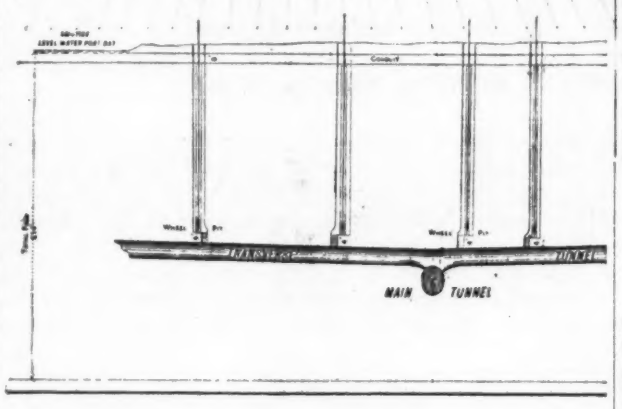
It is proposed to construct the main tunnel of an area equivalent to a circle 24 feet in diameter. Its mouth will be located as low as high water below the Falls will permit. It will have a descent from a point half a mile above Port Day to its mouth of one in one hundred, or $52\frac{80}{100}$ feet per mile. Above Port Day the tunnel will gradually diminish in size, in accordance with the number of mills which have yet to empty their tail-waters into it, until at the upper end it will be of the same area as the cross tunnels which flow into it at that point.

Sufficient land along the river has already been secured, surveyed and apportioned into mill sites fronting on the river and on the line of the proposed tunnel with ample streets and dockage, affording facilities for approach by rail or water, to accommodate 238 mills of 500 horse-power each, or 119,000 horse-power in all, which is the engineers' estimate of the capacity of the tunnel proposed to be built. Some idea of the magnitude and value of this power may be formed when it is stated that it far exceeds the combined available power in use at Holyoke, Lowell, Minneapolis, Cohoes, Lewiston and Lawrence, and that it can be constructed at an expense not to exceed one-tenth of the outlay for the development of the power at the places designated.

Based on the report of the engineer of the company, Mr. Thomas Evershed, C. E., of Rochester, N. Y., the entire cost of construction and land would not exceed $3,000,000, which, it is estimated, would allow of a handsome profit, with a charge for power far less than that existing at other places utilizing water power.



FIGS. 1, 2 AND 3.—THE PARRISH ELECTRIC TRAIN SIGNAL.

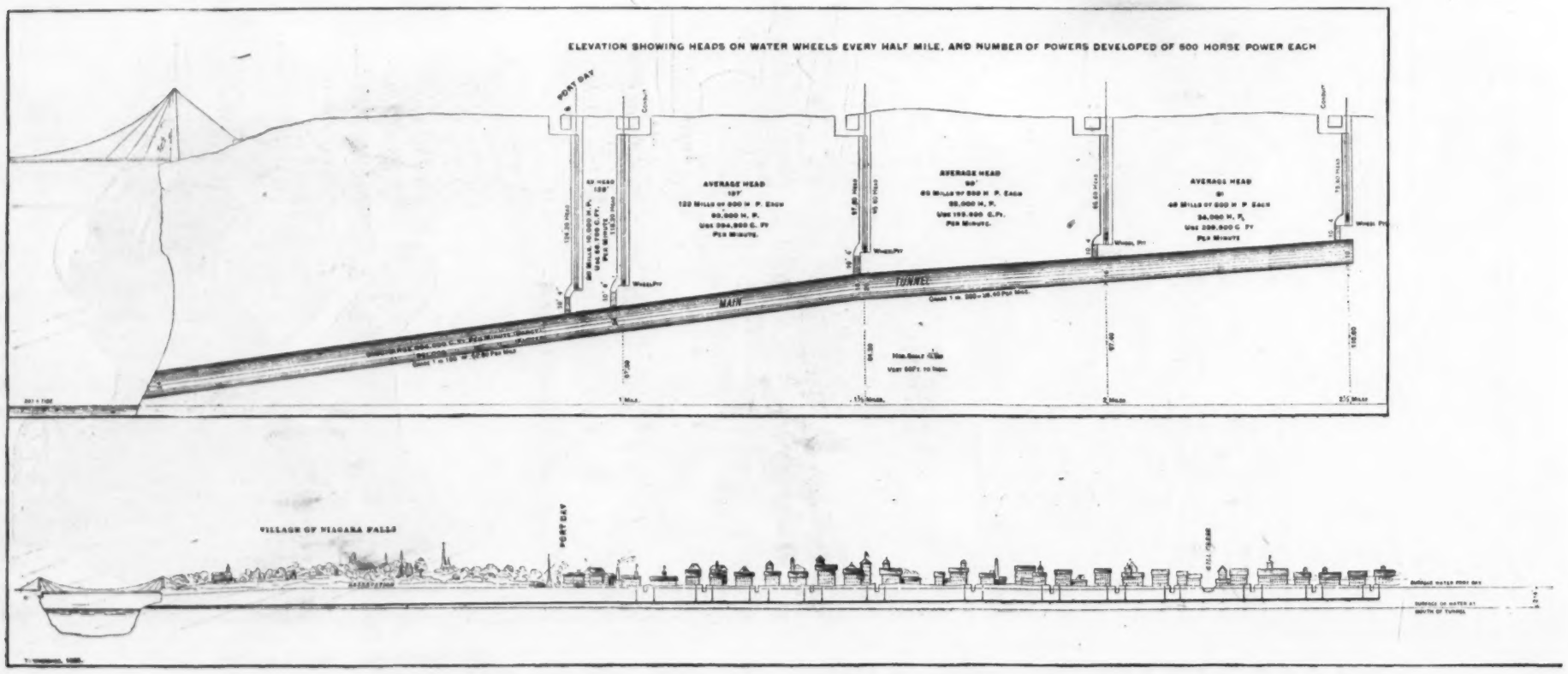


The Telephone in Sweden.

A correspondent in Hamburg, Germany, who has recently been on a trip through Sweden, writes us as follows: "Speaking of Sweden, you will recollect that you published some time ago in the World a description of the Stockholm telephone arrangements. There are two telephone companies there, and the city is supplied with about 6,000 telephones—4,000 from one exchange, with 35 operatives, and 2,000 from the other, with about 17 operatives. The writer was very much impressed with the magnificence of all the arrangements. The city authorities are so particular in their prejudice against placing any little houses on the tops of large buildings, that the "Almanna Co." in Stockholm, the one whose exchange you described, in their desire to bring the wires down from the iron tower to a little house where they could be joined on to the interior wires, had to resort to the scheme of hanging the house from the corners of the tower by iron rods. Its floor then is about a meter above the roof of the house, and its door is reached by a little wooden bridge. One of the most amusing uses to which the telephone is put in Stockholm is the ease with which the little steamers connect on to the line just as soon as they come up to the mole. They have errands to do in town every day for the summer residents about the harbor, and it is a great convenience certainly. They carry a little box on the captain's cabin all ready for attaching to the line."

The Parrish Electric Train Signal.

In its issue bearing date July 27, The Electrical World referred, in its Western Notes, to the installation of the Parrish electrical signal system on one of the passenger steamers entering the Chicago harbor. To-day outline sketches, Figs. 1, 2 and 3, are given showing the application of this system to railway trains. Represented by *a* is a section of the ordinary bell cord suspended in all trains, connected to two circuit breakers *B* attached to the respective ends of the coach. These breakers form a part of a circuit of concealed wires passing to the end of the roof of the coach where connection with the end of the next coach is made by means of the coupling *c*, the entire circuit being completed through the coils in an alarm bell and a set of Detroit storage cells placed in the locomotive cab. A signal can instantly be sent in from any coach in the train by a light pull on the bell cord, and any agreed system of signals can easily be carried on between conductor and engineer; while the addition of floor and wall pushes in express and mail


ELEVATION SHOWING HEADS ON WATER WHEELS EVERY HALF MILE, AND NUMBER OF POWERS DEVELOPED OF 500 HORSE POWER EACH
PORT DAY
AVERAGE HEAD
120 Miles of 500 H. P. Each
60,000 H. P.
Use 294,000 C. Ft. Per Minute.
AVERAGE HEAD
90'
60 Miles of 500 H. P. Each
30,000 H. P.
Use 193,500 C. Ft. Per Minute.
AVERAGE HEAD
48 Miles of 500 H. P. Each
24,000 H. P.
Use 200,000 C. Ft. Per Minute
MAIN TUNNEL
VILLAGE OF NIAGARA FALLS
PORT DAY

FIGS. 1, 2 AND 3.—PLAN FOR UTILIZING THE POWER OF THE NIAGARA RIVER.

cars will aid the passenger or route agent in sending in an alarm in the event of an attempted robbery.

In its application to freight trains, a closed system is also used, and the necessary circuit completed through sections of about sixty feet of heavy insulated waterproof wire, laid on the roofs of the cars, the slack wire being wound on, or from, a set of reels as cars are added to, or dropped from, the train. The danger signal is sent in by the conductor in his caboose by means of a push-button, or by the brakeman on the top of the train uncoupling a section of cord.

This system is owned by Parrish Bros. & Peck, of Detroit, the Chicago office being located in the Phenix Building, Chicago. The Michigan Central, the Chicago, Rock Island & Pacific, and the Chicago & Northwestern railways have this system in successful operation on their trains.

THE THOMSON-HOUSTON ROAD AT PLYMOUTH, MASS.

The Plymouth & Kingston Street Railway.

The electric railway built by the Thomson-Houston Electric Company for the Plymouth & Kingston Street Railway Company has been in operation since June 8 without interruption. The track is four and one-half miles in length, is built of steel T-rail, and extends from Jabez Corner about a mile and a half below the centre of Plymouth, and through Sandwich, Market, Leyden, Main and Court streets, in Plymouth, and through what is known as Spirit Pasture into Lower Kingston. The road is composed of a number of sharp curves and grades, the most difficult being Spring Hill on Market street. The track makes a sharp curve from Sandwich street and strikes at once a grade of 10 per cent., which the cars have to ascend, and upon reaching the top of the hill makes a double curve in Main through Leyden street. It will be seen from the above that a severe strain is put upon the motors, and that a motor car with a tow car attached, loaded with 125 passengers, will climb this hill with apparent ease speaks the highest praise of the Thomson-Houston apparatus. The motor cars, three in number, are each equipped with two 15 h. p. Thomson-Houston motors, and they receive power for operating from the Plymouth Electric Light Company, which operates an 80 h. p. Thomson-Houston generator. The single trolley overhead construction has been used throughout the length of the line. Almost the entire route overlooks the beautiful Plymouth Harbor, which makes it a very pleasant ride, and the fact that the railway company has to run two trains each way, consisting of a motor car and one tow car attached, and that over 2,000 passengers are carried a day, proves the popularity that the railway has gained with the citizens of the two towns.

The Brush Station at Rochester, N. Y.

Probably the finest water-power plant in the world for electric lighting is that at Rochester, N. Y., owned by the local Brush Electric Light Company, of which Mr. G. E. Mumford is president and Mr. G. A. Redman is superintendent. In view of the visit of the National Electric Light Association to Niagara Falls, near by, and the great interest that attaches to the utilization of water power, we have deemed it well to recall to our readers' minds the details about the Rochester station, given in these columns last year.

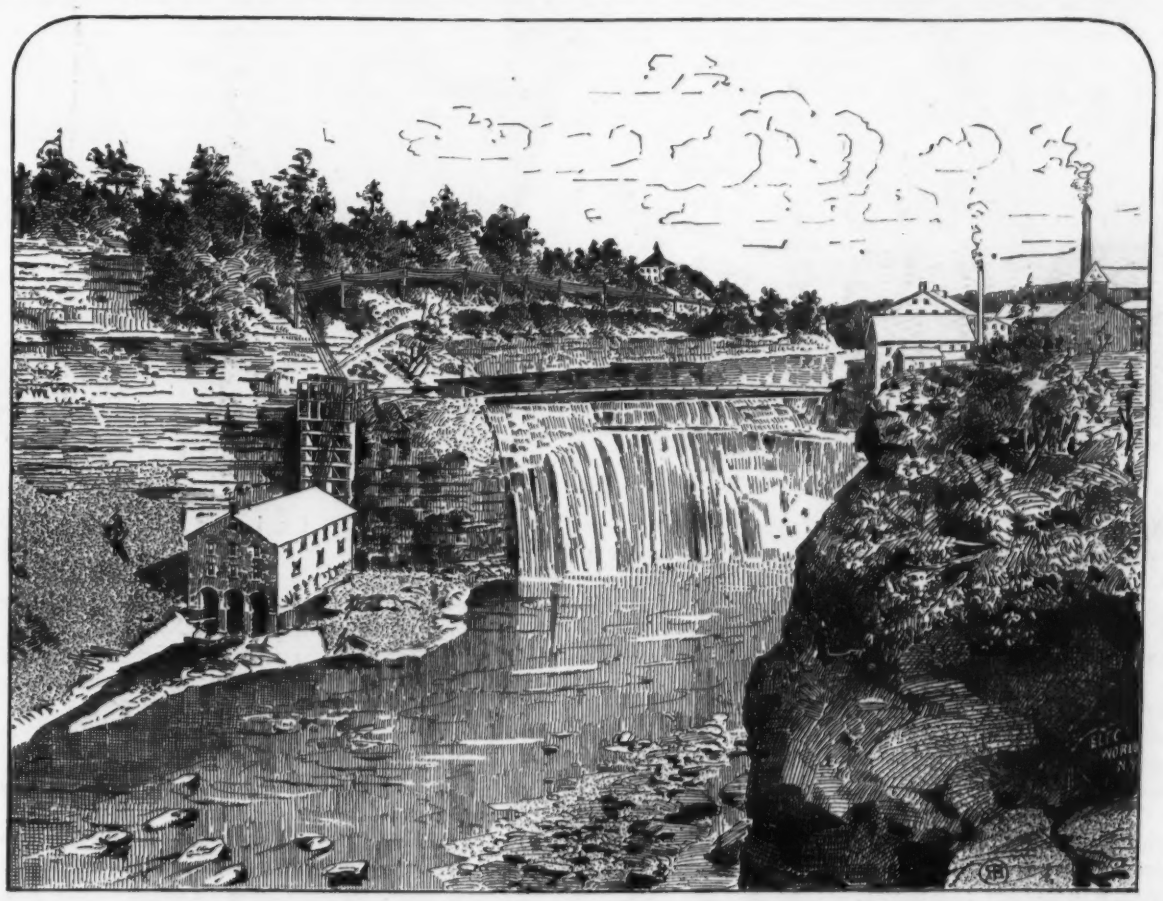
The Brush Electric Light Company's station at Rochester, N. Y., is located at the foot of the Lower Genesee Falls, two and one-half miles from the centre of the city. The falls are 94 feet high and about 350 feet wide. The river bank, just east of the station, is a perpendicular height of 187 feet. The station is built of stone, three stories high, 45 feet wide and 95 feet long, with iron joists and rafters and corrugated iron roof. The first story is used for tail races for discharge water from the turbines; the second story contains the turbine wheels, shafting and repair shop. All the repairs to dynamos, etc., are made at the station. The dynamos and switch-board are in the third story.

The turbine cases are placed on heavy iron beams set into the solid rock, and the shafting extends directly from the turbines and runs at a speed of 800 revolutions per minute. The bearings are all placed on iron bridge trusses that are securely bolted to iron beams and posts. Walks are placed a few inches above the shafting, so that the shafting and bearings can be easily and safely taken care of. Tallow and lard oil are used as lubricants. There are 15 double 15-inch Lesner turbines of 300 h. p. each, set horizontally, with 14 feet draft tubes, not using any wheel step or gears.

There are three penstocks, 6 feet in diameter, made of heavy boiler iron and bolted to the solid rock. At a point 75 feet from the top of the penstocks an elbow branches off to each turbine, so arranged that each can be used independent of any other. They are started and stopped by hand wheels placed back of and near the switch-board. At present 12 turbines with automatic governors are in service. The flume rack near the top of the penstocks is made of iron slats ½ inch apart and placed at an angle of 45 degrees. As a further protection a heavy horizontal wooden rack is placed in the race midway between the flume and the headgates.

The dynamo room is well lighted by eight large windows, and ventilated by the elevator shaft at one end and a four-foot New York exhaust ventilator at the opposite end. The elevator is run by a turbine and will carry a load of nine tons. The dynamos are placed in rows lengthwise of the building, on heavy wooden frames 22 inches high, bolted to 12-inch iron floor joists and belted direct to the turbine shafting below.

The company have from 15 to 20 miles of circuit on which they operate about 1,200 arc lights, some 200 motors and over 1,000 incandescent lamps.



THE BRUSH ELECTRIC LIGHT STATION, ROCHESTER, N. Y.

A Practical Opinion on the Alternate Current System.

To the Editors of The Electrical World:

Will you kindly allow me, as a subscriber to THE ELECTRICAL WORLD, the use of a short space to make a few remarks in defense of the alternating system of incandescent lighting? I am not actuated to this for the purpose of advertising any company or system, as we are in nowise connected with, or subservient to, the will or dictation of any manufacturers of electrical apparatus; but we frequently receive communications and letters from parties in the East, and, no doubt, other companies are likewise favored, whose ideas and inclinations seem to be derogatory to the use of the alternating system, relative to its safety and economy, and I would like to give to the readers of THE ELECTRICAL WORLD our practical experience with this system, which we decided to put in after several months of careful investigation into the relative advantages of the various systems of incandescent lighting.

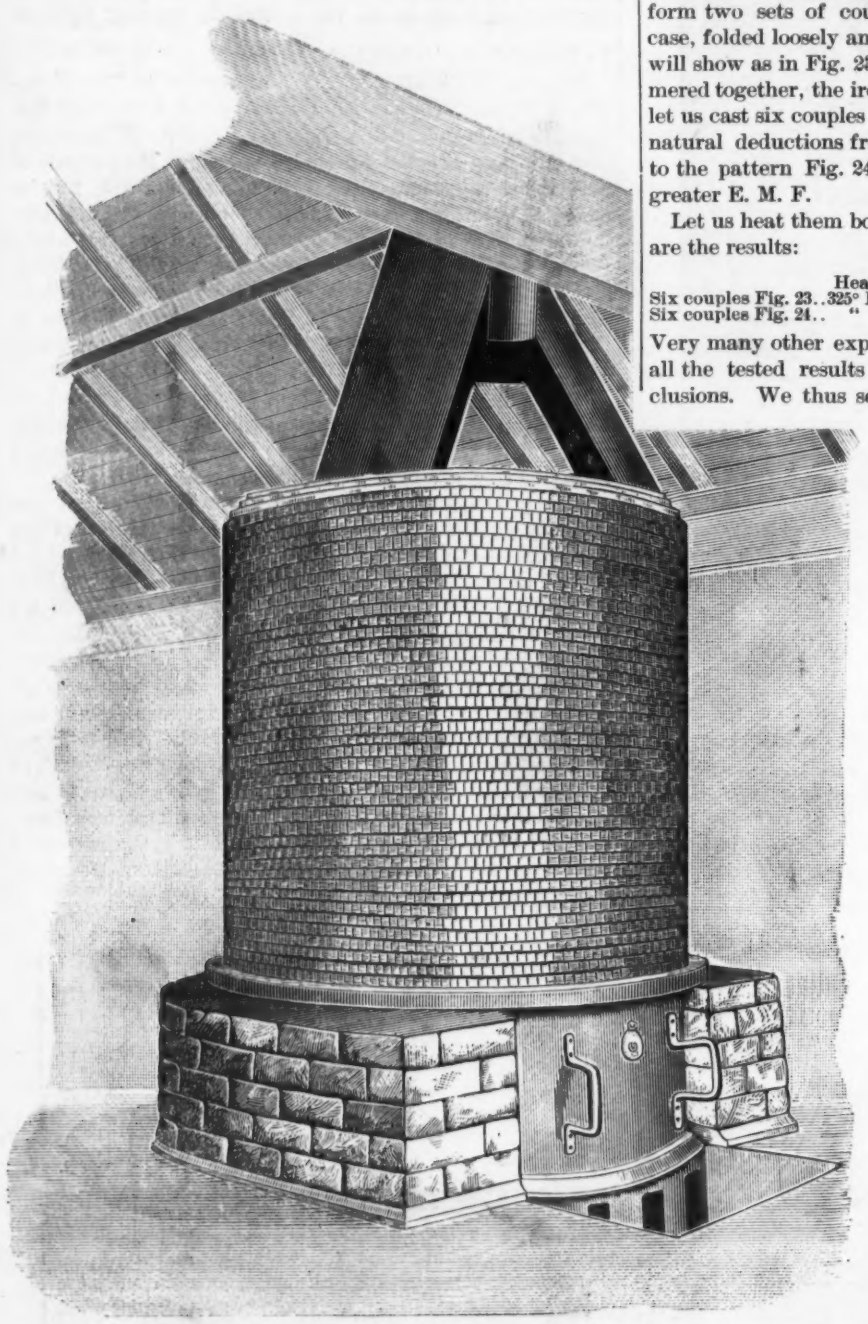
On April 27, 1889, we installed in our plant a Thomson-Houston alternating dynamo of a rated capacity of one thousand 16 c. p. incandescent lights, and on May 9 we started the machine with 200 lights. The service has been increased in numbers since then beyond our expectations. Our present high tension circuit is about 1½ miles in length, and is about equally divided between Nos. 4 and 6 wire, and this one circuit is carrying sufficient current to supply all the lamps we now have in use, while, if we had used any direct system for the number of lights and distance we are running, we would have required at least two circuits of wire so large that the cost would be in excess of three times the amount of the cost of our present wire and transformers. We have not as yet been obliged to do one cent of repairs on the machine since starting it, and the only attention it requires after starting is to keep the oil cups filled. Judging from the simplicity and strength of its construction, we do not anticipate any trouble from its getting out of repair.

Experts who have seen our lights state that they are superior to any direct system they ever saw. Recently a gentleman here who is connected with the largest direct system in this vicinity, upon asking whether we were obliged to replace many lamps on account of their burning out, would hardly credit the fact that we had not replaced one lamp as yet from this or any cause, whatever; or that we have been running on an average of ten hours a day for nearly three months. Yet we always run the lamps to their full

voltage, which we know is not the case with those using the direct system, as we have been informed that the loss is very great on account of the lamps burning out when run to their full voltage.

From facts gleaned from those interested in central stations, hereabouts at least, I am satisfied that the alternating system will take the place of the direct as fast as those using the latter are able to make the changes.

In regard to the safety of this system, we are using weather-proof wire for our circuits, and none of our employés have ever had the least shock, either from the machine or out on the line, although they have frequently connected the wires to the transformer and put up and connected on lights, while the current was on. During a severe storm recently, the water worked through our tower, running down the switch-boards and wires, which necessitated our wiping off and covering up in a manner we would not attempt on our high tension arc circuits.



FIGS. 25, 23 AND 24.—STUDIES IN THERMO-ELECTRICITY.

Speaking from our experience, I am free to say that I would much prefer taking the chances of running the alternating system than any other, both from an economical point of view and also on account of its safety, for we know the current is perfectly harmless after leaving the transformer, as we have been able to demonstrate on several occasions; and the so-called dangerous high tension current and transformer may always be left outside and out of the reach of any one. This is not the case with our twice as dangerous arc currents, which we cover buildings with, both inside and out.

I am sure that all local companies that have had experience with these two systems will endorse my sentiments, and will condemn the tactics used by those who, either to obtain notoriety for themselves, or pay from opposing interests, use this unbusinesslike method to influence public sentiment in their favor and against that which is not only an improvement, and more satisfactory to the users of electricity, but which is to the best advancement of electrical interests throughout the country.

B. P. FOSTER,
Manager Findlay Electric Light & Power Company.
FINDLAY, O.

Electroplating of Glass and Porcelain has been accomplished by M. Hanson, of France. The chief difficulty heretofore has been to obtain a conducting surface to which the metal would adhere. The patentee uses chloride of gold or platinum dissolved in sulphuric ether, to which sulphur dissolved in some heavy oil is added. When warm, this compound is laid on with a brush. The object is then heated until the sulphur and chlorine is completely volatilized, the gold or platinum adhering closely to the surface.

Thermo-Electricity Theoretically and Practically Considered.—III.

BY ARTHUR RUST.

The true law of thermo-electricity is:

The electromotive force is proportional to the rate of speed at which heat passes the two junctions.

Turning to Figs. 16 and 17 for a moment, let us notice that the peas *always* fall off the Z-A first. This shows, as we intimated before, that they receive the heat sooner, and are soon hotter than the iron molecules, and that the Z-A molecules, Fig. 19, strike in frictional stress against the iron. But it shows more; for if the iron is allowed to penetrate into the body of the Z-A, a counter E. M. F., or drag, is set up, and the greatest E. M. F. is produced by the first thrust of the heat of the Z-A molecules against iron. Everything favorable to that naturally produces better results by promoting greater continuous friction of the molecules.

Let us now take 16-mesh iron wire gauze as before, to form two sets of couples, and fold it in three. In one case, folded loosely and not pressed together, the iron gauze will show as in Fig. 23; in the other, pressed or even hammered together, the iron gauze will show as in Fig. 24; now let us cast six couples upon each of these, and to bear out natural deductions from Figs. 16 to 19, the six couples cast to the pattern Fig. 24 should show the best results, or a greater E. M. F.

Let us heat them both up to about 325 degrees F.; these are the results:

	Heat.	Galvr.	Tang. Galv.	Galv. and 1,000 ohms.
Six couples Fig. 23..	325° F.	75°	6⅛° and 35¼°	30°
Six couples Fig. 24..	"	77½°	7⅛° and 44°	32½°

Very many other experimental couples were constructed, all the tested results of which indicated analogous conclusions. We thus see, comparing these last facts with Figs. 15 and 22, that the investigations are abundantly verified.

I made another experiment upon one of the same kind of couples, trying what effect could be obtained by putting it into a powerful vise. After carefully insulating the jaws, connecting the leads up from the couple to the galvanometer, and putting considerable pressure upon the handle of the vise, I found about two degrees indicated. Left thus for about ten days the same current was shown; left again, but this time for three months, all the current had gone. But on unscrewing the handle of the vise, the galvanometer indicated a small reverse current.

I have thought it better, as mentioned at the outset, to confine our attention to those two metals in conjunction with each other. In dealing with other metals or alloys, their physical properties and characters have to be carefully examined and thoroughly inquired into, to understand, in a small measure, what work their atoms and molecules are doing.

It is most interesting to turn up the experiments of Erman, who showed that a violent blow struck by one substance upon another, produces opposite electrical states on the two surfaces, and found that taking the thermo-electric series of metals, each substance will take a + charge on being struck with one lower on the list: Bismuth, German silver, lead, platinum, zinc, copper, iron, antimony, etc. This again goes to prove the theory with which we started, since the violent blow given places the molecules of each of the two metals, each substance having physical properties of its own, in a state of stress, so that if these blows could be continuously delivered, cog wheel friction would be set up, and an E. M. F. produced. Since this stress—this state of molecular tension—this static electricity remaining—always runs to the weakest part of any particular body, it naturally remains upon any point of a large body where the molecules are most at liberty to come into play, rather than in the mass of the body itself; and perhaps the molecules of the larger part of the body are acting as a stress upon the molecules of the pointed or smaller parts of the body.

We think we have now shown what we started to prove. The molecular movements that take place in a thermo-couple are only a sample of what must take place in all of the various other sources of electricity mentioned at the outset. The same kind of actions of molecules and atoms are brought into play in the chemical combinations of the voltaic cell, in the revolving magnets of a dynamo, in the heated junctions of the thermo-couple, and in every other source of electricity.

There are not two electricities, but one. The solid earth, with its immense storehouse of quadrillions of trillions of billions of molecules may be taken, for the sake of argument, as resting at zero, and when molecules, by what means soever, are placed in a state of potential stress, which we call +, or a lacking void, which we call —, mother earth, when brought into connection with them, is ever ready, so far as it is able, to give them what they require, and let them, in a measure, return into a state of rest. With the earth's great storehouse to help we are thus able to bring "the Thing called Electricity" into use for the various purposes for which it is now employed.

We think these explanations point to the fact that the vibrations produced by heat upon molecules and atoms, similarly constituted, are of the same kind and act together; but when these atoms or molecules are differently constituted, so that they respond to the heat vibrations in different ways, the different sets of molecules act one upon another and bring into play a different set of physical elastic properties, which produce other molecular motions—which new molecular motions or vibrations continue in a flow, right along the conductor, to its destination, and which is the current electricity of our present telegraph service. If a too strong potential is turned upon a thin wire, the impact on the molecules or cogs is more than they can bear, so that the wire is unable to carry the potential; the atoms and molecules being pushed out of the angle to which they are capable of swinging, the molecules come into counter friction with each other, producing heat, which, if allowed to go on, raises the wire to a state of incandescence and eventually burns it up.

Of course current electricity or molecular vibrations take the easiest path, and naturally those on the outside of the wire, in contact only with the atmosphere and the ether, vibrate the most easily. Thus it is made clear that when the electric wires are covered, as in cables or underground wires, the covering interferes with the free molecular stress or vibration, and slows the telegraph speed, as is so well-known.

An illustration has sometimes been given of current electricity as a series of billiard balls connected together; hit one, and the last one replies. *Such is not a true representation of the case.* It rather resembles a series of cog wheels; vibrate one, and the last molecular cog at the other end of the metallic connection turns, vibrating in reply. The billiard ball illustration would more aptly apply to the telephonic instruments which occasionally have been arranged to work on the same wire and at the same time as the cog-wheeled vibratory current electricity.

Professor Clausius has stated his belief that there are only two material forces at work—heat and electricity. I believe there is only one (save the physical material properties of matter), viz., heat, and that electricity and light proceed from it.

The relative positions of molecules and atoms in solids being fixed, and contiguous to each other, when the expenditure of force comes, effects are communicated that are well known. Molecules in the liquid state more readily glide past one another, and they assume the form of any vessel in which they are placed. Molecules in the gaseous

state are still more susceptible of motion, depending upon the pressure to which they are subject; but as a molecular solid passes into a liquid before it can pass into the gaseous state, so in the gaseous state the gaseous molecule must still retain some connecting link with its liquid molecule, and this again with a solid molecule. Professor Tyndall has ably and conclusively proved this, and has shown that molecules, after they have been released from the bonds of cohesion and reduced to a state of vapor, still retain, in this gaseous form, many of the differences and peculiarities that they possess in the solid form.

We have shown that with a small couple a moderate current can be produced. Imagine large numbers of these acting with each other, or huge quantities of matter in electrical *stress* in the earth, and we will get some idea of one of the powerful factors which must have been at work in the formation of our world. And this idea will be strengthened by aid of the belief that when bodies fall into the sun, forming sun spots, with their gaseous flames of 50,000 to 350,000 miles in length, huge molecular electrical friction is set up, generating such vast electrical energy that it is communicated through a distance of 93,000,000 miles, and when it reaches our earth the effects are felt by the increased daily variations of our magnetic needle.

Regarding the beautiful electrical experiments in vacuum and partial vacuum that have been made by Professor Crookes, are not the results, with these views, what might have been expected? And if an absolute vacuum can be formed, which would be analagous to taking all molecules and atoms out of existence in that space, the certain result would be no electric current could pass; *there are no molecules and atoms* to convey the electric current across such a vacuum to the second pole.

Without enlarging more fully at present upon these investigations, does not electricity, with the conclusions derived from the new facts described, become a much simpler and a more understandable science than what we have hitherto been accustomed to think it is?

I may state that I have, in the course of these experiments, among other things, used as one item 18 cwt. of antimony. and to test conclusions I constructed an electrical furnace, shown in Fig. 25, which has 6,000 elements. The heater, which occupies the interior of the cylindrical arrangement of elements, is a slow combustion stove of particular construction. In the centre it is fed by a continuous tube, charged with coke from the top; this opens at the end into a fire-box or basket, closed at the bottom by bars, and on these bars is placed a cone, which causes an outward distribution of the fuel as it descends from the supply chamber. Around this supply chamber there is a concentric casing filled with sand, which retains the heat for many hours after the fire has burned out, and prevents the heating and cooling from taking place too rapidly. Outside this last casing there is again another casing concentric with it, and between these there are three spiral flues. The heat and products from the fire ascend by these flues, and at the top of the casing there are three apertures by which the products of combustion are delivered in a common up-take which leads to the chimney.

In this way, and by the help of regulating flues, the exterior casing is very equally heated; a sufficient temperature is easily maintained, and this without any risk of overheating the elements. The inner faces of the thermo-elements are in close proximity to this heated casing, although not electrically connected with it. Thus the requisite heat is supplied to the couples, and each row being connected together by binding screws for convenience, the total number of elements can be arranged row by row, either in one circuit or multiple arc as desired. The electrical current flows as described, and can be employed for any purpose for which it is required.

The stove, simply as a stove, was found capable of producing a tremendous heat, and from an actual trial in testing, before the thermo-elements were added, allowing all the dampers, etc., to be out, and giving it full play, within twenty minutes of lighting the fire, such heat was generated that lower parts of the iron furnace melted like wax.

This electrical furnace, or magnopile, gave in actual work an E. M. F. of 96 volts, with a resistance of 11.5 ohms. This resistance need not have been more than 10 ohms, and better results can yet be obtained. The cost was at the rate of about 12 cents per 10 hours. Prof. Silvanus P. Thompson who, on several occasions, has kindly given me instructions in the construction of the magnopile, advises me to make it known. Through other pressing engagements, I have been taken completely away from this work, and have not had opportunity to complete it commercially, but it is certainly only a matter of time and detail. A magnopile will assuredly be completed, and will, in the future, be a commercial success.

After attending the British Association last year at Bath, and hearing the address of the President of Section A, describing electricity as "The Thing called Electricity," I am induced to offer, after a two years' silence, these facts and thoughts to the scientific world—the true explanation of the phenomena of electricity.

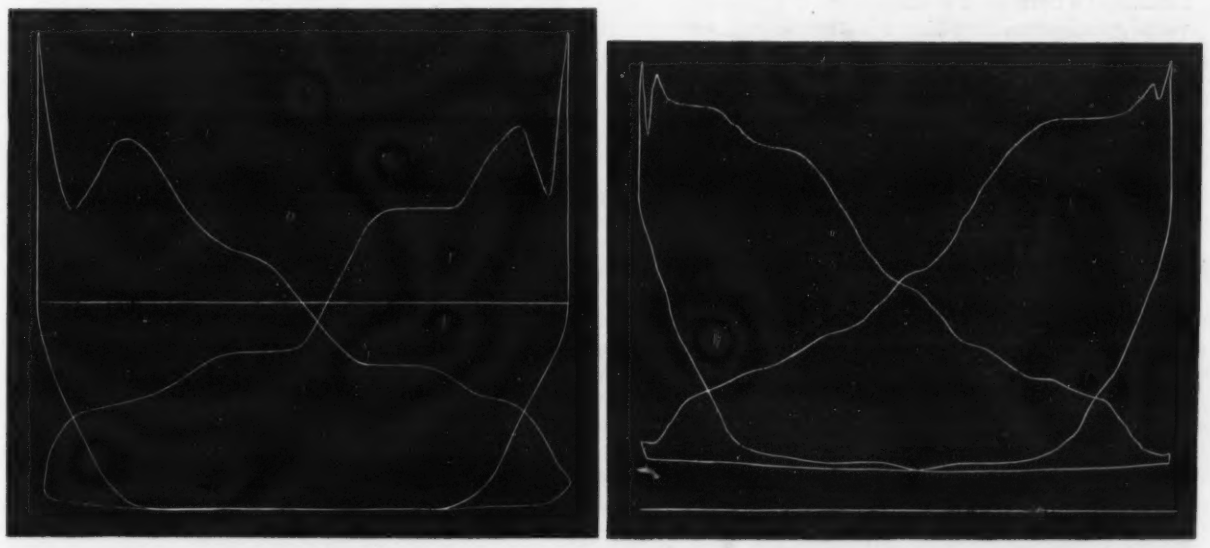
The Victor Arc Plug and Socket.

The accompanying illustrations represent a form of plug and socket that is very desirable for switching arc light, power and other heavy currents. It is known as the Victor arc plug and socket, and is manufactured by The E. S. Greeley & Co. While the device is new and novel, is is not so in the sense of being experimental or untried, as a number of the plugs have been in use during the past year under the severest conditions in arc light service, and have given unqualified satisfaction, which has led to their exclusive employment in stations where they have been on trial. The socket, as will be seen, consists of a double chamber of solid cast brass, into, or from, which the plug can be quickly thrust or withdrawn. The plug, consisting of heavy spring metal of appropriate shape, secures broad surface contacts on its four distinct faces, as well as on the edges, which not only guarantees the connection, but holds the plug firmly in position. As no time is lost in fitting the plug to the socket in making changes, but it is quickly snapped into place, the most rapid character of work in switching is the result. The sockets are also made in a duplex form when required, so that the second connection may be established before the first is disturbed. The sockets may be neatly mortised into cabinet work and fitted almost flush with the wood surface, and thus make a very attractive as well as convenient switchboard.

FIGS. 1 AND 2.—THE VICTOR PLUG AND SOCKET FOR HEAVY CURRENTS.

Power Plant in the Yonkers, N. Y., Electric Light Station.

Next to efficiency, the greatest desideratum in electric light stations is economy of space, fuel, power and wearing parts. But economy is not so easily attainable in establishments of small size as in large ones, as every practical electrician and engineer will admit. It will therefore interest many, we believe, to read the illustrated description of a plant which is in operation at Yonkers, N. Y., and which, though small and subject to considerable variations in the time for burning and closing the lamps, is regarded as a model of economy in each of the particulars mentioned above.



FIGS. 1 AND 2.—INDICATOR CARDS, YONKERS, N. Y., ELECTRIC LIGHT STATION.

The power plant consists of two Rice automatic engines, to each of which are attached two arc dynamos and one alternating dynamo of the Thomson-Houston pattern, and these are so arranged that a third engine, with dynamos, can be added when it shall become necessary.

The Rice engines are a conspicuous and important feature of the Yonkers station. They were built by the John T. Noye Manufacturing Company, of Buffalo, N. Y., under the personal supervision of Mr. F. B. Rice, the well-known engineer, who has been associated with that company for a number of years. They are of the tandem compound condensing type, with 9 × 16 high-pressure and 16 × 16 low-pressure cylinders. The speed is 240 revolutions per minute, and the boiler pressure from 90 to 100 pounds.

Some remarkably good indicator diagrams were taken from the engines last spring, a pair of which, Figs. 1 and 2, we publish herewith for the examination of the critical. These cards will make their own appeal to the practiced eye of the engineer, their excellence being so great as to at once draw his attention. They were taken with a large-sized Thomson indicator, using a 40-pound spring, and at a time when the load consisted of seventy 1,200 candle-power arc lamps and 250 incandescents. The coal used is of good quality, and the economy in fuel is particularly noteworthy.

The general plan of the station is also deserving of notice. Engine, condenser and boiler feed-pump are arranged within a rectangle of the smallest possible size. A close-coil heater is placed between the low-pressure cylinder and the condenser, which insures high temperature of the feed water before it passes to the boilers. The engines are run with the throw-over, so that the bottom side of every belt is the tight side, thus reducing the chances of slipping belts. To save in floor space, the dynamos are stepped, one back of the other. The whole is arranged to secure economy in space with easy accessibility of every working part.

The success of the Yonkers station demonstrates the fact that no electric light plant is too small to repay by its economical operation the increased first cost involved in getting the best possible machinery, and shows that the type of engines there in use has a great future in connection with the production of electric light.

Dynamo Regulation for Railway Work.

To the Editors of The Electrical World:

Would you be kind enough to inform me regarding the Van Depoele generator and resistance in use here. We have always run the generator with the resistance boxes connected in multiple with the armature circuit or the external circuit. The exciter to the generator is series wound. Would it not be better to connect the resistance in the exciter circuit as the fields of the generator heat? The generator is 100 h. p., running at 725 revolutions per minute; the exciter runs at 1,650. Please inform me as to whether the speed is right. J. H. J.

ANSWER.—The method under which you are now operating with resistances in multiple with the armature or line is a very wasteful one, and explains the heating of the coils. It would certainly be better to connect the rheostat with the exciter and field circuit, and to regulate the field instead of the main circuit, as at present. As you do not give the other conditions involved, we cannot express an opinion on the matter of speed. This can probably be best furnished by the makers.—EDS. E. W.

A Curious Effect of Lightning on Steel Line Wire.

To the Editors of The Electrical World:

I send herewith a few pieces of what was a No. 14 steel wire, which was in one of our lines from Oneonta to Delhi, N. Y. The line was struck by lightning at Meredith Square on July 19, and for the first 80 feet the wire was cut up in the manner shown by the samples, and for 320 feet more it was cut into pieces of from 2 inches to 2 and 3 feet. It melted the copper wire on the telephone and also the ground wire attached to the telephone, but did no injury to the instrument. It first struck a tamarack tree standing near the line, stripped it of all the bark and shivered that into splinters, but threw no splinters from the trunk of the tree, and it now stands a mark of what the lightning will do.

PAUL T. BRADY,
Supt. Central New York Tel. and Tel. Co.

COOPERSTOWN, N. Y.

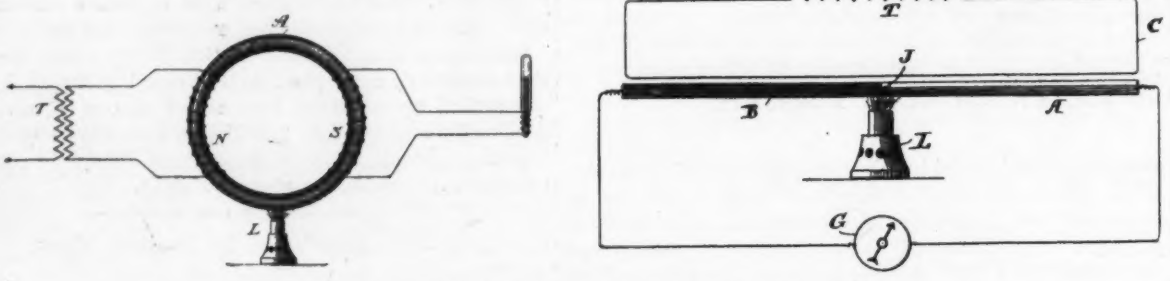
The specimens sent by our correspondent consist of pieces of wire varying in length from ¼ inch to 1¼ inches. All of them have the appearance of having been fused. Several pieces are actually fused together, and all present a dark, glossy appearance, as if coated with plumbago. The manner in which this wire was broken in short lengths reminds one forcibly of the experiments made by Plante in passing the charge from his "quantity" rheostatic machine through a fine platinum wire, which assumed characteristic nodes of vibration and finally became brittle and broke.—EDS. E. W.

Acheson's New Calelectric Generators.

The work of Mr. Edward G. Acheson, of Pittsburgh, on the conversion of heat directly into magnetism and electricity is already known to our readers.* Briefly stated, the method devised by Mr. Acheson consisted in causing heat-lines to traverse an electric conductor and produce a magnetic whirl, cutting the heat-lines, and thereby converting the heat energy into electric energy.

Since commencing this work, Mr. Acheson has elaborated various other methods analogous to the first, one of which is shown diagramatically in Fig. 1. The arrangement consists of an alternating current generator, with a converter so arranged that the iron core may be put under the influence of heat, a thermometer being included in the secondary coil of the converter as a current and heat indicator.

With an apparatus arranged as above indicated and having a given current at *T*, with the source of heat removed, there is registered on the thermometer a certain value representing the electric energy traversing the coil *S* and its



FIGS. 1 AND 2.—ACHESON'S CALELECTRIC GENERATORS.

circuit. But when the source of the heat, *L*, is placed in proper position to cause the heat-currents therefrom to impinge upon the mass of magnetic material, with the source of energy at *T* the same, it is found that the thermometer shows an increased value for the electric energy in the coil *S*.

Mr. Acheson explains this action on the assumption that if heat can be converted directly into electricity it should also be possible to produce magnetism from heat energy, and if this is the case the application of the heat energy to the magnetic material will result in an increased magnetic state of the magnetic mass, which will react upon the coil of wire surrounding the mass and produce therein an electric current, which will represent a part of the energy of the heat. While Mr. Acheson has not yet been able to clearly demonstrate this fact, he has demonstrated fully that the application of heat in the manner described does produce a material increase in the current flowing through the coil *S* and its connections.

Another interesting development in this line of work has been made in its application to increasing the efficiency of the ordinary thermo-electric couple. Mr. Acheson has discovered that if the two elements forming a thermo-couple be so situated as to be within the influence of lines of magnetic force while at the same time heat currents are traversing them, there will be a conversion of the heat-currents, as a result of the presence of the lines of magnetic force, and a current of electricity will be produced of a value greater than that due to the ordinary thermo-current, in fact, to the sum of that current and any current resulting from induction.

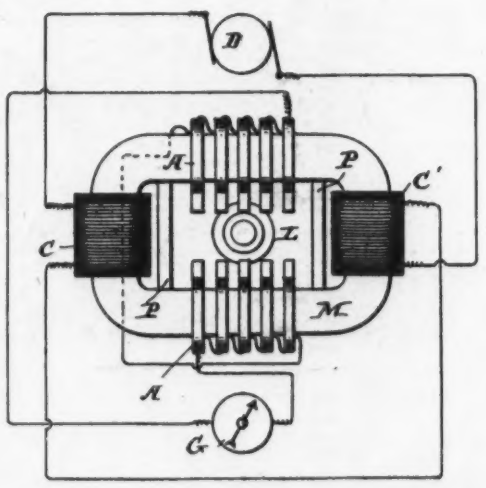
Referring to the diagram Fig. 2, *D* is an alternating current dynamo, *T* a transformer, and *C C* the circuit closing the terminals of the transformer, a portion of which circuit is parallel with and adjacent to the two elements *A B*, forming a thermo-couple. Arranged in proper relation to this couple is a source of heat *L*, and in the circuit of the couple is a galvanometer *G*, which is represented, in the present instance, as a galvanometer.

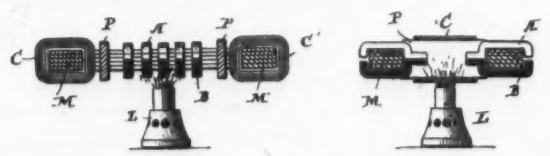
Mr. Acheson finds that if the source of heat *L* is removed and an alternating current is caused to pass through the circuit *C C* by means of the generator *D* and transformer *T*, the galvanometer *G* in the circuit of the thermo-couple will show that a current of a certain definite value is circulating in the circuit, composed of the elements *A B* and the conducting wire. Again, he finds that when the generator *D* and transformer *T* are removed electrically and no alternating currents are used in the circuit *C C*, upon approaching the point of junction *J* of the thermo elements with a source of heat, a current of another certain definite value is generated and is indicated upon the device *G*. Now, when both of these functions are produced together, that is, when the generator *D* is run and the transformer *T* is operated and alternating currents are produced thereby in the circuit *C C*, and the heat is at the same time applied at the point of junction *J* of the thermo-couple—a much larger current is indicated in the galvanometer than would be produced as the sum of the two former values. This extra energy, thus demonstrated as being produced by the conjoint operations, is attributed by Mr. Acheson to a conversion of a portion of the heat energy that was applied at *J* into electric energy, and the amount of this conversion will, to a great extent, depend upon the particular form and proportion of the apparatus made use of.

In the primitive form indicated in the diagram definite results have been obtained; but in the form illustrated in Figs. 3, 4 and 5, as well as in other forms, more pronounced results have been obtained.

In these illustrations, *M* represents a core of iron built up of plates or wire. *C C'* are coils of wire corresponding to the circuit *C* of Fig. 2, through which coils the currents produced by the generator *D* are sent, and which are used to magnetize the core *M*. In the present instance these coils *C C'* are shown connected in series, although they may be otherwise connected. Arranged upon opposite sides of this core are the elements *A B*, forming the thermo-couples, and they are placed so as to embrace the core and have their points of junction *J* adjacent to each other within the limits of the core. These couples are shown as connected in series in order to get the strongest effects, the positive element of one couple being connected to the negative element of the next couple.

The source of heat, *L*, is arranged midway between the sets of couples, so as to direct the heat upon the points of junction of the couples. Mr. Acheson has found it convenient in this construction to make use of partitions *P*, of non-heat-absorbing material, to aid in applying and directing the heat-currents to the thermo-elements. It will be understood that in this arrangement, when an alternating or intermitting current is caused to traverse the coils *C C'*, there will be produced reversals or variations in the magnetism of the core *M*, and this will cause lines of magnetic force to cut the elements *A B* of the thermo-couples, and therefore the currents of heat flowing through them. This cutting produces a conversion of the heat currents into electric energy, and this energy is added to or superposed upon the energy produced by other sources of electric energy, as above stated.





FIGS. 3, 4 AND 5.—ACHESON'S CALELECTRIC GENERATOR.

Electric Light in Iron Mines.

The managers of the Iron King, Pabst, East Norrie, Norrie, Aurora and Ashland iron mines, at Ironwood, Mich., have contracted with the Ironwood Electric Light Company to light these mines with 16 c. p. incandescent lamps, the work requiring in all some 1,200 lamps, and the peculiar conditions, as well as the fact that these are the first iron mines to be thus lighted, make it of interest to all engaged in mining matters as well as electric lighting.

The mines being very damp, it will be necessary to use heavily insulated cable, and the contractors have arranged to run only secondary wires below the surface, so that the potential at no point will be higher than 60 volts at the most. The wall wires will be run in heavy molding, and at every drift sockets will be placed so that flexible cords may be run into the stopes and lamps attached thereto. Along the levels lamps will be located every 40 feet, and at the intersection of the levels and shafts there will be two lamps. To provide against accident, two circuits will be run into each mine, one on each side of the levels, so that in case one circuit should give out or become interrupted, the other will continue to furnish light.

The apparatus will be furnished by the Thomson-Houston Electric Company, and the work done under the direction of Mr. F. N. Bosson.

More Electric Cars for Cleveland.

The success of the East side electric railway, in Cleveland, O., has been so great, and its popularity with the citizens of Cleveland has been so marked, as detailed in our paper recently, that it is not surprising that we have to record this week that another street railway company in Cleveland has decided to adopt electric power upon its lines.

This company is the Broadway & Newburgh Street Railway Company, of which Mr. Joseph Stanley is president. The line is now operated by horses. The contract which this company has signed calls for sixteen complete electric car equipments of the latest Sprague type, and using the Sprague improved electric railway motor, necessary dynamos, station equipment and other necessary apparatus.

Before deciding upon what system to use on this line, the president and vice-president of the road, Mr. H. E. Andrews, has visited a number of electric street railways, and the decision was finally made in favor of the Sprague system, as recorded.

Cleveland may now be regarded as one of the leading electrical cities of the West. One of the electrical railways now in operation in that city, the East Cleveland Railway Company, has steadily running 20 electric cars, each drawing a tow car, making 40 in all, and it will soon have 80 more cars operated by electricity. It is an interesting and noticeable fact, that nearly every road which has been equipped on the Sprague electric system has ordered an additional number of electric cars. Among the roads equipped on the Sprague system, besides the Cleveland, which have added to their original equipments, are Wilkesbarre, Pa., Wilmington, Del., Tacoma, W. T., East Harrisburg, Pa., Akron, O., Reading, Pa., Atlantic City, N. J., etc.

The Three-Wire Arc System at the Amoskeag Mills.

To the Editors of The Electrical World:

I would like to make a few corrections to the statements made in the World of July 20 by Mr. W. J. Jenks.

On pages 41 and 42, in the paragraphs relating to Fig. 20, he says: "In fact the entire motive for its temporary use in these two systems appears to have been the distrust naturally felt in the early history of the art with relation to the reliability of the machines themselves. Hence this middle wire was an 'emergency' conductor, merely serving to keep in operation one-half of the system if the other half broke down.

"The best evidence of the fact that it was not only useless but dangerous, is found in its abandonment by the company, as no other plant is on record as having been thus equipped. With the further practice in the arc light field these original ten-light machines were supplemented by others of larger capacity, and greater faith in the reliability of the apparatus caused constructors to omit any such emergency wire as being not only a possible source of danger to the system, but a useless outlay of copper."

The above is in relation to the "middle" or "neutral" wire, as used in arc lighting by us for many years. If the middle wire is a source of danger, we have so far failed to realize any of the evil results from it. It was never intended as a compensating wire or an emergency wire, although it would undoubtedly be very handy in case of accident to one-half of the circuit.

It was done purely and simply as a matter of economy, and was not in this case a "useless outlay in copper." The device was used on the ten-light Weston machines of the old series winding. It was necessary to burn all or none of the lights, as there was no regulator attached to the machine. Some rooms in the mills had to be lighted long before others did, and it was to save running two distinct circuits, or four wires, that the three-wire device was resorted to. Each half of the circuit was started, as called for, or both at once, as occasion demanded, by the use of conveniently arranged switches on each machine. The United States Company did not equip our plant with anything but machines and lamps. We then did, as we now do, our own installing, and the three-wire device was original with Mr. L. B. Jones, at that time (1881) Superintendent of the Electrical Department of the Amoskeag Manufacturing Company.

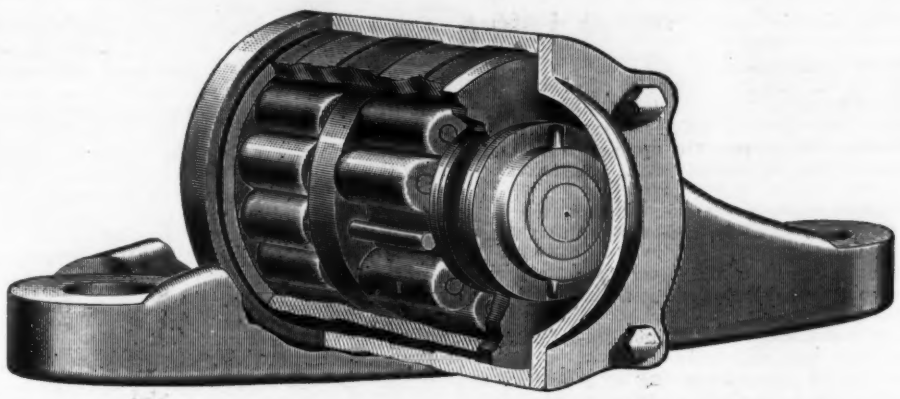
Those original ten-light machines have never been supplemented by others of larger capacity, we having twenty-one running very satisfactorily to-day. As there are continual changes in the kinds of work done in the mills, so we have to change the lamps to correspond, and at the present time have no three-wire circuits, but are quite likely to use them at any time.

E. R. Robinson,
Electrician to Amoskeag Manufacturing Company.

* See The Electrical World, Jan. 7 and 14, Feb. 25, 1888.

The Tripp Anti-Friction Journal Bearing.

The work lost in friction at journal bearings is frequently a large percentage of that required to operate machinery, thus leaving only a fraction for the real work to be done. In railroad work especially much depends upon the conditions of the journal bearings, and the power required to haul cars may be decreased considerably by proper attention to this point. This is of importance in the operation of electric cars, and to meet the demand for an efficient bearing the Tripp Anti-Friction Journal Bearing Company, of Boston, have brought out the journal bearing shown in the accompanying engraving.



TRIPP'S ANTI-FRICTION JOURNAL BEARING FOR ELECTRIC CARS.

This bearing is constructed on a new principle, by which the axes of the rolls are always kept in line with the axis of the shaft. The journal boxes are absolutely dust proof, and one lubrication will answer for a year's constant service.

By recent tests with the dynamometer on the tracks of the West End Street Railway, of Boston, which is now changing its equipment from horses to electric power, it has been demonstrated that a saving in power over the ordinary journals of from 30 to 70 per cent. can be effected by the use of this journal.

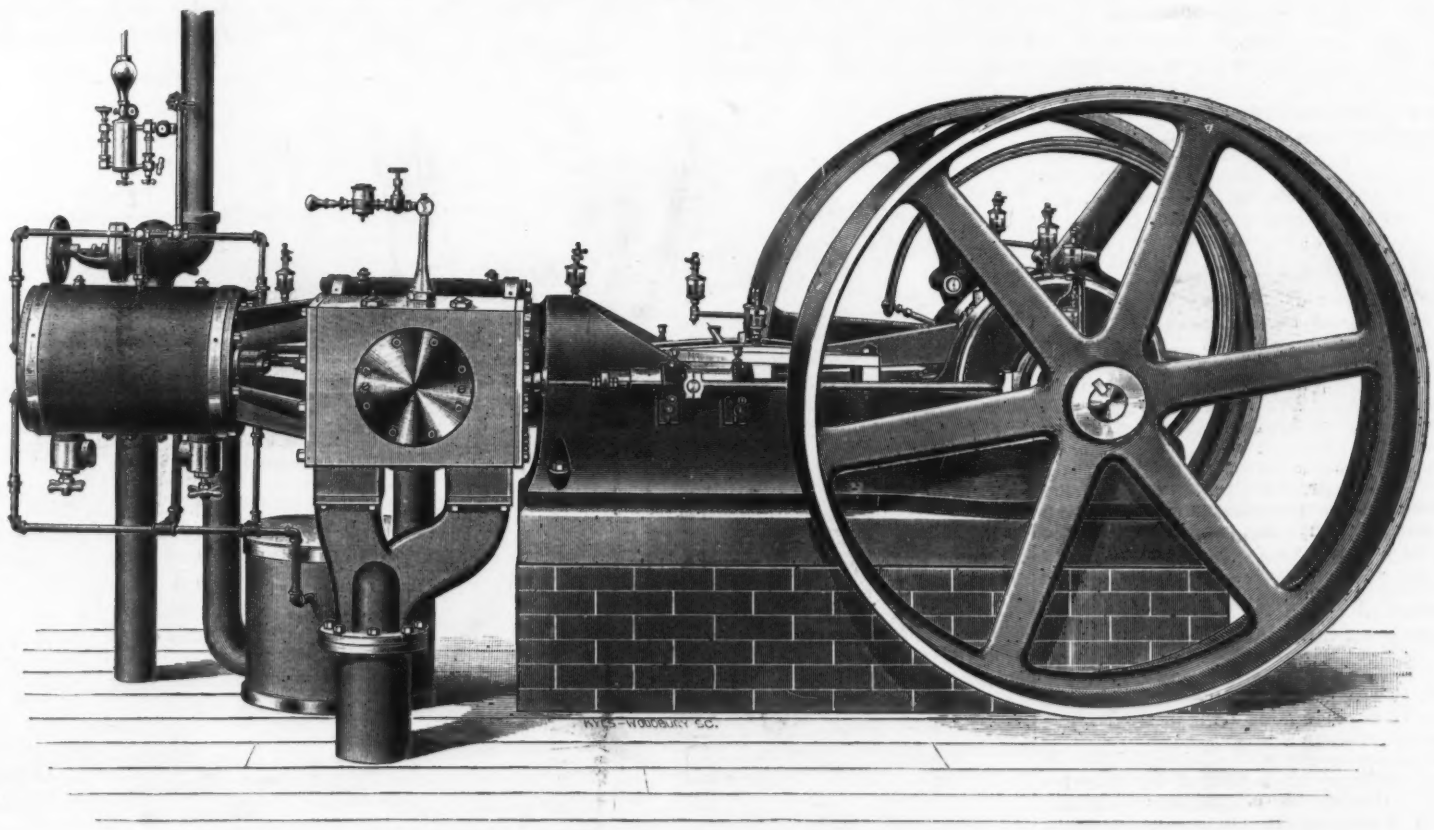
The New McIntosh & Seymour Tandem Compound Engine.

Much has been said and written concerning the respective advantages of the two systems of arranging power plants for generating electricity, and each plan has its earnest champions among practical men who have had much experience. Subdivided power avoids entirely both the great waste of fuel due to running an engine under a light load and the necessity of shutting down from an accident to any one part of the apparatus; and direct belting to dynamos, with its simplicity, freedom from friction and other disadvantages, due to the use of shafting, are the prominent advantages gained when a number of smaller engines are used. On the other hand, when large, slow-running engines with shafting have been employed it has been possible to use a more economical type of engine. It was felt that there would be a great demand for an engine which, while possessing the essentials requisite for direct belting, such as simplicity, small attendance required, and capability of running at high speeds, should be of an economical type. The McIntosh & Seymour special compound engine was designed to meet this demand, and has met with great success since its introduction over a year ago. In many cases the users report a saving of over 40 per cent. in fuel over high-speed engines previously in use, and with no more care or attendance.

The general style of this engine is shown in the accompanying engraving. It is a horizontal tandem compound engine of the double-crank class, with two overhanging wheels and is entirely self-contained. The high pressure cylinder and receiver have steam jackets. The chief and most important peculiarity is the arrangement of the high and low pressure valves, each with its actuating gear being placed on opposite sides of the engine. This feature is patented, and is believed by the manufacturers to be essential in a successful high-speed compound engine. It is the only arrangement of a tandem engine which permits each valve to be driven in a direct and separate manner without a complicated driving gear. The tandem form is necessary for smooth running at high speeds, for it is impossible to "cushion" on the low-pressure side of a double compound engine, since the cylinder exhausts into a vacuum, while in a tandem engine sufficient compression may be obtained in the high-pressure cylinder alone.

The governor or automatic cut-off regulator, valves, frame, shaft, and the moving parts generally are similar to those of the well-known McIntosh & Seymour high-pressure engines. The workmanship and material used throughout are the best that can be obtained, and each engine is subjected to a thorough test before leaving the shops.

In a situation where a condensing engine cannot be used, this engine can be furnished adapted to run non-condensing. The saving over single-cylinder high-pressure engines is claimed to be still very considerable, although not as great as when used with condensation. The manufacturers of this engine, Messrs. McIntosh, Seymour & Co., of Auburn, N. Y., have brought out a full line of sizes varying from 50 to 300 h. p.



THE McINTOSH & SEYMOUR ENGINE FOR ELECTRIC LIGHTING.

Questions on Automatic Regulation, Distribution, Calibration, etc.

To the Editors of The Electrical World:

Please answer the following questions in the columns of your paper, which I think will benefit not a few of your readers: 1. When an arc machine is running with, say, half its load of lamps, using an automatic regulator, is not the same mechanical power required, and is not the machine generating the same number of volts as when running full load? 2. What is the advantage of the three-wire system of incandescent distribution? 3. In calculating the sizes of wires in incandescent distribution, where branches are taken from the mains, is the same drop to be calculated in each branch or divided between the number of branches? In other words, must the full drop be calculated in every branch? 4. Can a voltmeter or ammeter be used to measure any current or potential, provided the same is within the range of the scale of the instrument, or do they have to be adjusted for the particular system on which they are to be used? 5. What is meant by calibrating an instrument.

STUDENT.

WASHINGTON, D. C.

ANSWER.—1. In all properly designed arc systems, and as is the case in nearly all arc systems in use at present, the automatic regulator serves to cut down the number of volts generated by, and hence the power consumed in, the dynamo, practically one-half, when running on half-load. Thus only one-half the power is required under these conditions. 2. The employment of the 3-wire system effects a saving of 62½ per cent. in the weight of copper over that which would be required by a 2-wire system; hence it is more economical in large distribution. 3. The drop determined upon must be taken for each branch individually, and not collectively. 4. Instruments of this class designed for the measurement of the continuous current would probably serve for nearly all the various systems now in use, within the range of their scale. This, however, does not apply to the alternating or interrupted continuous currents, which require special instruments, those usually employed for continuous current measurement being unsuitable for this purpose. The Cardew voltmeter, however, is an exception to this rule, being equally applicable to both continuous and alternating current measurement. 5. Most instruments are provided with scales or marks which indicate the various values within the range of the instrument. These scales and marks, however, being independently constructed, rarely represent the true values indicated by the instrument. Hence it becomes necessary, in order to obtain accuracy, to determine the exact quantities indicated by the various points on the scale. This is usually done by comparing the indications of the instrument with a standard of some kind, and making due allowance for the error in the scale reading of the instrument to be calibrated, when the latter is direct reading. When the instrument is not direct reading the calibration usually results in the establishment of a constant or factor, by which the scale reading must be multiplied in order to give the true value.—EDS. E. W.

The Heating of Converters.

To the Editors of The Electrical World:

Will you please inform whether it is possible to so overload a converter on the alternating current system as to heat it red hot, even with the primary mains connected to the converter without the intervention of fuses, and also the same with the secondaries?

W. E. G.

ST. JOSEPH, MO.

ANSWER.—Under certain conditions a converter might possibly be heated to redness when unprovided with fuses as mentioned. But it is probable that a fusion of the copper wire itself would occur before this point was reached, so that the converter would be thrown out of circuit, or its action so interfered with that heating to such an extent could not take place. In the absence of experimental data it would be difficult to predict the possibility of the heating to *redness* of the iron core of a converter, for it will be noted that as the heat in the iron increases, its magnetic power decreases. Now, at a red heat, iron has no magnetic properties whatever. Thus the very heating of the iron in a converter would deprive it of those qualities upon which its heating power depends. It is true that converters may become heated sufficiently to ignite combustible material in contact with them, but we have never heard of one becoming *red-hot* as the result of its own action.—EDS. E. W.

A New Annunciator Drop.

The accompanying cut, which is full size, represents a new annunciator drop introduced by Messrs. Edwards & Co., of New York City. The special claims made for the new device are compactness and simplicity of construction. It has a positive lock until released by the magnet, which makes it especially adapted for use on steamboats, etc.

It is so arranged that it will discharge any residual magnetism every time the tag drops, so that the armature cannot stick. The raising arrangement is so constructed that

A New Annunciator Drop.

it will only interfere with the drops that are down; thereby avoiding the strain that would otherwise ensue. It is low in price and is sold either mounted or unmounted.

An Improved Cabinet Turret Lathe.

We illustrate herewith a new and improved cabinet turret lathe made by Lodge, Davis & Co., of Cincinnati. This lathe swings 18 inches, and has a 6 foot bed. It has all the advantages usually furnished with first-class cabinet turret lathes, with the addition of power feed, and an appliance for boring or turning any taper with power feed. The operator can bore or turn a taper and face off his work square without setting over the lathe head. This saves much time and labor. The reverse for the feed is in the apron, right at the hand of the operator. The slide has a large range for setover, and has the lever and screw movement for the top slide. The turret is of large diameter, steel bushed, and has two set screws for clamping each tool. The machine entire is very heavy, weighing 2,200 pounds As will be seen, it is built to meet the demand of electrical manufacturers and electrical engineers, and is now in use in several large electrical works.

Mr. Gutmann on Electrical Execution.

A REPLY TO MR. H. P. BROWN.

To the Editors of The Electrical World:

In The Electrical World of July 27 Mr. Brown makes some statements which require correction. I have never been asked by the firm I am connected with to write any articles in favor of the alternating current, nor have I ever asked for permission to do so; my motive for writing was to prevent misrepresentation, and, secondly, to protect humanity, and not, as stated, due to any other interest.

It is nowhere stated by me that the primary current is safe to handle. On the contrary, in my last reply, I have said that currents under a pressure of 1,000 volts may, under proper conditions, be made to kill. Nevertheless, it must be maintained that the distribution by means of converters is safe as long as all apparatus employed is well insulated and properly installed. The primary current does not enter into the question, as the public has nothing to do with it, and those employed to handle it, do so every day, know the danger and the required precautions. Knowing that unreliable work is done, I advocate the adoption of higher pressures, so that manufacturers and constructors *must use* more precaution, design water and fire proof apparatus and develop the details of the system. If then unreliable work is done a fault develops much more rapidly, and on account of the increased pressure the breakdown occurs so much more quickly; *we have either a perfectly safe system or a complete breakdown*, as proved in your issue of Oct. 8, 1888.

I must state furthermore that it is immaterial to me whether direct or alternating currents be used for capital punishment. The individual does not enter into the question here, and neither have I any great admiration for the Westinghouse Company, nor am I an "enemy" of Mr. Brown, so that neither of these reasons can justly be put forward as the real cause of these articles.

With regard to the experiments and their reliability, I must say that the readings as indicated by the instruments have, no doubt, been properly stated; nevertheless they are worthless if we remember that a comparison has been made between a shunt dynamo and a separately excited machine, of which neither the field exciting current nor that flowing in the armature has been measured. A dynamo with a field excitation three times as great in one case as in another must, of course, be capable of doing more work.

To make this controvery less personal, and to enable the intelligent reader to form his own opinion with regard to the reliability of electric machines and to the "slight difference" existing between theory and practice, I have in this, my last reply, treated the matter by drawing up questions which I have answered in my way, leaving it to the reader either to accept my answers or to substitute for them his own.

Q. 1. Can you kill by electricity, and what pressure will suffice?

A. We can kill with electric currents obtained from alternating or direct current machines having a pressure of 1,000 volts or more.

Q. 2. Is death instantaneous, and is suffering connected with such treatment?

A. Death is not instantaneous with a current of 1,000 volts, but the man does not suffer, as his nerves do not act normally, they being no longer sensitive.

Q. 3. Is there a way of producing death quicker?

A. There is, (1) by using electric currents of 2,000, 3,000 volts or more; (2) the guillotine, or (3) prussic acid.

Q. 4. Which is the safest?

A. First, prussic acid; then the guillotine, and last electricity.

Q. 5. Will an electric current with a pressure of, say, 3,000 volts, kill "in every case?"

A. It is certain that the current, when properly applied, will kill in every case.

Q. 6. Is the resistance of a human being equal wherever measured?

A. No; the resistance from hand to hand is different from that measured from foot to neck or head, or taken from one foot to the other.

Q. 7. How does the electric current affect the resistance of the body?

A. It tends always to decrease it.

Q. 8. By measuring the greatest resistance of a body, can we predetermine the pressure that will "invariably" kill?

A. Any human being can be killed with a current of 3,000 volts if moistened electrodes are applied to the body and carefully adjusted; the measurement of the resistance is superfluous.

Q. 9. Are there any dynamos constructed that will produce currents having a pressure of 3,000 volts, and is there any difficulty in making them?

A. There are such dynamos in the market, and there is no difficulty in making machines producing, at their terminals, a pressure of 3,000 volts.

Q. 10. Is there any doubt or uncertainty that a current with a pressure of 3,000 volts will kill?

A. There is no doubt that an alternating or a direct current of 3,000 volts, when properly applied, must always kill.

Q. 11. Can we depend on a dynamo that produces the current to kill instantly and without fail?

A. No, never. There is no dynamo in existence the action of which any man can guarantee, neither is it possible to construct a machine, even if specially designed, for the purpose for which we can guarantee. It is beyond the means of this world to construct "perfect" apparatus so as to be infallibly certain.

Q. 12. If everything is carefully made especially for the purpose, and of the best material, can we not then rely upon the dynamo?

A. No. There is no reliance to be placed in any moving machinery.

Q. 13. What are the causes that make moving machinery unreliable?

A Boilers and engines can give out at any time, caused by loose bolts, broken valves, etc.; electrical machines can give out by a loose connection, bad terminal contact, breaking of a wire on the exciter, action of centrifugal force on the armature, sudden rush of current through the circuit, subsequent slipping of belt and many other causes.

Q. 14. Suppose that after a careful inspection of all apparatus, proper contacts and connections are established, is it certain that the alternating dynamo will kill?

A. No. An armature moving at 1,600 revolutions, having a diameter of two feet, has a peripheral speed of about 10,000 feet per minute. The wires wound over the drum are not only exposed to strain by centrifugal force, but also to that due to any sudden increase of pull which may vary from ½ to 5 or 8 h. p.

Q. 15. Is there any strain on the armature winding besides that due to mechanical causes?

A. Yes, there are in the armature (referring to those adopted by the State), 16,000 current changes or reversals, which cause a strain on the insulation of neighboring wires, which strain is the greater the smaller the power consumed in proportion to the excitation.

Q. 16. What possibilities are there to be expected in the case of electric execution?

A. 1. The dynamo kills the culprit and receives a strain. 2. The dynamo kills the culprit and destroys itself by rupturing the insulation of neighboring wires or at the collector. 3. The dynamo destroys itself before killing the culprit, but renders him unconscious, in the case when the resistance of the insulation of some layers or turns is equal to that of the condemned man. 4. The dynamo destroys itself at the moment of, or before, closing the circuit on the man and consequently cannot kill or hurt him if the insulating resistance of the wires is materially smaller than that of the man.

Q. 17. Can every workman handle the electric machines?

A. No; on account of the great pressure and for proper testing and supervision of instruments, an expert is required.

Q. 18. Can the executioner be certain that a culprit, sitting motionless in a chair, is dead?

A. No, he does not know anything about it until he learns "the fact" from the doctors; it may easily happen that, through some fault in the exciter or dynamo, the condemned man receives a very severe shock, is rendered unconscious, but will come to after several hours, and then we are not certain whether we have to do with a man who has his full reason, or whether, owing to the position of one of the electrodes, the shock has made him insane.

Q. 19. Then the executioner is just as uncertain as the culprit as to the success of the operation?

A. Yes, he can never predict; he can only state the result when properly ascertained.

Q. 20. Have alternating machines given out at any time?

A. Yes, very often indeed. Some of them are so recorded in the electrical papers in 1887 and 1888, and over ten times as many are not reported.

Q. 21. Suppose one dynamo has been used for execution and has proved that it can kill, is not this a sign that it will be just as successful at any subsequent execution?

A. It is possible, and probable, that a dynamo will kill one, or even two or three men; but each execution is less reliable owing to the strain exercised on the armature winding on previous occasions. Just as certain as we are that a high tension current must kill, so certain is it that the moment must come when one culprit has to be tortured ten and hundred-fold, expecting to be killed at any instant; but the seconds seem to grow into hours, and after such a torturing suspense he must learn from the surprised executioneer that the dynamo has given out, but that he will have another chance.

Q. 22. Is the strain on a dynamo and especially on an alternating current machine the same when used for light as when used for execution?

A. The strain on an armature is much greater when applied for execution.

Q. 23. What is the difference?

A. Dynamos are generally operating devices either in series or in parallel. When they are arranged in series the dynamo produces a current which flows in succession through all the devices. The pressure produced at the terminals depends on the number of devices, each of them taking a fraction of the total. If we have, for instance, 10 arc lamps, requiring 50 volts each, in circuit with the dynamo, then it produces 500 volts at its terminals; if we double the number of lamps we find 1,000 volts at those terminals, while the pressure for taking the current through each lamp remains the same. It will thus be seen that it lies within the nature of the machine to produce a pressure which is completely consumed in the devices and the current arrives at the opposite terminal with a potential of the same nature and amount as at that terminal.

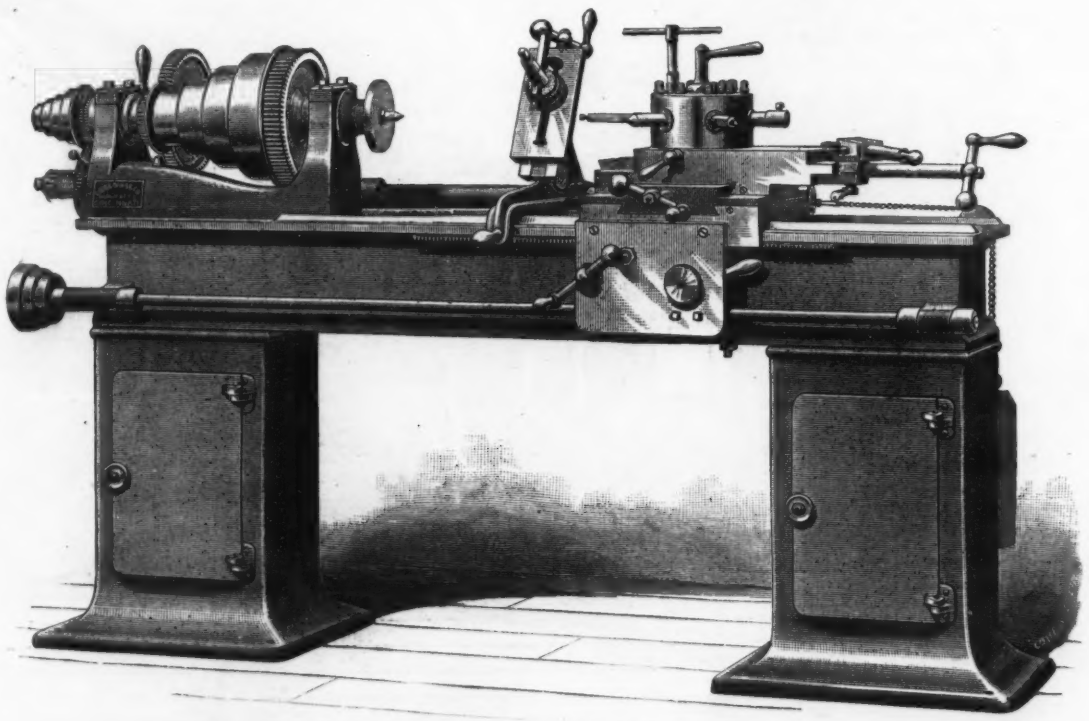
If the devices are grouped in parallel each of them has at its terminals the same and the maximum pressure, and the resistance has to be such that the fraction of current sent through it will require the total pressure at command. In electric execution this law is not maintained, the object in circuit receiving maximum current with maximum pressure.

Q. 24. What would be the consequence if we discard this law and place an arc lamp in parallel instead of in series in an arc circuit, or if we have a constant pressure of 120 volts, and we place a device which will require but 45 volts to send the necessary current through it, say an arc lamp across the line?

A. The pressure, not being completely consumed, causes an increase of current to flow through the device, which current, having a higher pressure than that of the opposite terminal, re-enters the armature and causes a strain which generally destroys the armature, technically called "breakdown by short circuit."

Q. 25. How can this last state be compared with the conditions for capital punishment?

A. The pressure chosen is 1,000 volts or more; the body is placed in series with the generator to receive the full current produced. Under the influence of the current the resistance in the human body decreases, and a rapidly increasing current of high pressure passes through the body and re-enters the armature, which thereby receives a severe strain that ultimately must result in a break down, due also to the sudden increase of pull or work in the armature; this probably amounts to a change within 30 seconds of from ½ to 7 or 8 horse-power. This strain is exercised on a wire moving with a speed, in this particular case, of 10,000 feet per minute.



NEW CABINET TURRET LATHE.

Q. 26. Is the alternating current dynamo the best machine for the purpose?

A. No, it is the weakest and least reliable machine that could have been selected for this purpose, because in this type of machine there is the greatest amount of internal work which decreases with increase of load when the current is "consumed" in an external circuit, but would increase the strain on the armature when not completely consumed. We can compare the working of an alternating current dynamo for light and power distribution with a high-speed engine, the valves of which are properly adjusted, while the same dynamo when used for execution will work like a high-speed engine in which the valves close too quickly, so that the piston would have to work at each stroke against, say, one-fourth of the steam pressure. In the former case the strain on the insulation is comparable to that on the cylinder head and cross-head.

Q. 27. Which is the most reliable electric machine, and on what does reliability depend?

A. No electric machine is perfectly reliable. The safest and most reliable machine is any two-pole dynamo, because it has the least internal work, and, putting workmanship, quality of goods, speed, etc., equal, the reliability decreases as the number of field magnet poles increases. A two-pole dynamo is five times more reliable than a ten-pole machine.

Q. 28. Is it, then, possible to predict the work of a dynamo, and can we accept the guarantee if such is given?

A. We can never predict anything with certainty; and a man who guarantees the continued working of a dynamo without fail must be considered insane.

Consequently, the whole answer lies within a nutshell. *Theoretically* we are certain of killing with a current of high pressure; *practically* we do not know from one second to the next whether the dynamo will give us *that current* which it is required to produce. *Theoretically* we have the current, but *practically* we have only the machine.

NEW YORK CITY. L. GUTMANN.

Special Correspondence.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
167-177 TIMES BUILDING, NEW YORK, August 3, 1889.

The B. F. Goodrich Company, of 65 Reade street, have, it is well known enjoyed great success in their manufactures of hard and soft rubber goods for electrical work, including sheets, rods, tubing, telegraph supplies, accumulator cells, primary cells, push button shields, etc. Mr. J. Pierrez, their representative, has made business "hum" this season through his energy and enterprise, and they report sales larger than ever.

The New American Arc Light Company, of 18 Cortlandt street, have recently installed at Dobbs' Ferry 50 arc lights of their system. They have also put in 100 lights at Seattle, Wash. Ter., and 200 lights at Perth Amboy. The company are pulling themselves together and "getting up and doing" in a remarkable manner; they have made great headway since the reorganization, and they have the satisfaction of knowing that the old customers for the system are still among its warmest advocates.

Mr. F. H. Hayward, M. E., of Williams & Potter, the Straight Line engine representatives, 15 Cortlandt street, had just returned by the flying "City of Paris" when I dropped into the offices last Wednesday. He looks well and has gained in weight. He has greatly enjoyed the exhibition at Paris, and has much that is interesting to say about the American display, especially that in Machinery Hall. He is also greatly gratified at the success of the Straight Line engines shown, and expects to have some interesting news about them later.

The Clark Electric Company.—An arc lamp now attracting considerable attention is the improved form recently devised by Mr. E. P. Clark, and brought out by the above company, of the Corbin Building, Broadway. It gives a powerful, steady light, and is well up to the most exacting requirements. A special feature is the fact that the lamps are storm-proof, and do not require any hoods to protect them. They will stand any weather. A considerable saving in the first cost of an arc plant to the purchaser is the result of this improvement. I need say nothing about the Clark dynamo, as the machine is too well known to need description.

The Zucker & Levett Chemical Company have removed their offices to 40 Murray street and their works to Flushing, L. I., where some time since they bought 12 acres of ground and have erected buildings, one 75 × 345, one 50 × 100, and two 25 × 50; the first is three stories high and the second two stories. The new factories are well equipped in all the various departments, including foundry, machine shop, chemical rooms, buff department, brush department, laboratory, stearic acid departments, nickel refinery, cyanide of potassium department, etc., etc. They have made improvements in all their departments, sparing no expense to have the most approved machinery and appliances. The company's well-known "American Giant" dynamo, for electro-plating and electrotyping, has been greatly improved, running with less power, giving a steady and non-reversible current, and insuring economy and superior results wherever used. The company also manufacture everything appertaining to electro-plating and polishing of metal and other goods. Their nickel anodes, salts, rouges, compositions, buffs, etc., are well known all over the world, and are used by all the leading manufacturers.

The Carter Magnetic Ore Separator.—I had an opportunity last week of seeing the Carter magnetic ore separator at 131 William street, where it was treating some sand obtained from a point in New England. A leading feature of the separator is that it has permanent magnets and therefore does not require dynamos, etc., to run it. Long iron bars, their front surfaces rounded somewhat, form the permanent magnets. There are eight tiers of these, one above the other, and each tier is made up of three rows of iron, the lower rows receding gradually from the upper row. The ore, in a finely ground state, is allowed to drop before the upper tier of magnets, whose power is strong enough to draw the iron particles toward it, the sand, thus subjected to successive winnowings, dropping straight to a receptacle below. The iron and any foreign substance is thus passed before the second tier, which carries the separation still further, and so on until finally the iron is entirely free from any foreign substance and deposited by itself at the bottom. The capacity of the machine may be increased almost without limit as the magnets may be extended in breadth as much as desired. No skilled labor is required, and the machine may be set up anywhere without regard to power. It is in actual operation at the office of the Carter Magnetic Ore Separator Company, who own the patent. The separator does good work, showing heads about pure and tailings comparatively free from iron.

The Medbery Patent Indurated Fibre Pipe for Underground Wires.—In your issue of June 8 you described and illustrated the Medbery underground system, consisting of indurated fibre pipe made by the American Indurated Fibre Company, of Mechanicsville, N. Y., with offices at No. 311 Broadway, this city. Since then I have obtained some additional interesting particulars regarding this method of running wires underground and the results of a number of tests made with the pipe. The pipe is made by a patented process, from long wood fibres, separated, washed free from all saps and gums, molded while in a pulpy state into the requisite size and shape and then subjected to great hydraulic pressure, after which it is treated and hardened by a chemical process that makes it completely impervious to moisture, acids and gas. For use in electrical conduits its advantages are, briefly: Its high insulating properties and long life, the fibre being apparently indestructible; its low cost, together with economy in laying and maintaining; the easy access which it affords to the necessary points for connections, and finally its lightness and strength. The pipe is not injured by acids, alkalies or atmospheric conditions. It is perfectly water and gas tight, and will not rust, peel or scale, nor become coated with lime or affected by sulphur. It does not warp, shrink or swell in any way, as there is no perceptible expansion or contraction from change in temperature or from moisture. A pipe conduit of this kind has been used under the direction of Mr. Wm. Ettinger, division operator of the Pennsylvania Railroad Company, who says that it is giving entire satisfaction in connection with underground wires. It has also been used and is highly praised by Dr. S. M Plush, general manager of the Bell Telephone Company, at Philadelphia. Mr. W. L. Church, of the Westinghouse, Church, Kerr & Co., has also tested it and says that it is certainly very satisfactory.

The following is a copy of the test made by the electrician of an electric light company in this city on an indurated fibre pipe 5 feet in length, 2 inches inside diameter, ⅜ inch shell:

The first test with sulphuric acid, nitric acid and hydrochloric acid, had no effect. A test was then made with heat which had no deteriorating effect; the pipe would burn under intense heat, but would not ignite so as to support combustion from an electric arc. An electric test for insulation was then made; 2,000 volts had no effect on the ⅜-inch shell. The electrical resistance measured infinity. The pipe was then buried in damp ground for a period of three weeks, and subjected daily to the action of heat, water and acids. An electrical test was then made, using a current of 2,000 volts pressure; no current could be obtained through it. It showed no signs of deteriorating in this period of time, and did not absorb moisture, as the screw joints were as free after as before the test. The report also states that the breaking strain is sufficiently high to prevent accidents from any ordinary weight coming on any ordinary length, and that the screw joints are sufficiently strong for any underground pressure liable to occur, and that it is impossible to break the pipe when properly laid.

As a result of a test made by a chemist to whom the pipe has been submitted, his résumé says that the pipe will stand a temperature of 300 degrees Fahr. without injury; and further states that the pipe held together fairly well, even when subjected to a temperature of 500 degrees.

I have alluded to its capabilities mainly with respect to electric light uses, but there is no reason why it cannot be used equally well for telegraph, telephone or signaling wires. The electric light problem has been the hardest one to solve, and this pipe, it would appear, has solved it.

The following brief description will illustrate the method of protecting an underground electric light wire: One or more pipes can be laid in the trench not more than two feet from the surface of the street. Each pipe will be, say, 1 inch in diameter with a shell ⅛ inch thick. The pipe will be made in 5-feet lengths, fitted on either end with screw threads which are screwed into collars for pipe connections. The screw threads are first lubricated with cement, which prevents any sticking, and makes it easy to screw them tight. The collars have on each end a sleeve ⅛ inch in length, so cut as to leave a space between the pipe and the collar of ⅛ inch. This leaves a receptacle on each side where the pipe enters the screw, which receptacle is filled with cement. If the house lots (as in a large city) are 25 feet frontage, a junction box is placed every 50 feet to provide for service pipes between each two lots. These junction boxes are simply enlarged collars, and in practice will have an inside diameter or 3 inches, with ⅝-inch shell, the side connection or tee-joint 1 inch in length, and the enlarged collar is fitted with three reducing plugs into which two main pipes and the service pipe can be screwed. The whole is then carefully cemented.

In practice each electric light wire is to be placed in a separate pipe. The wires are to be covered with rubber insulation 3-64 inches thick, also served with a stout cotton braid or tape; and finally just before being drawn into the pipe the wires are to be thoroughly slushed down with cement, which will act as a lubricant, and also afford additional insulation. W. T. H.

PHILADELPHIA NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
31 City Trust Building, Philadelphia, Pa., Aug. 1, 1889.

Messrs. H. T. Paiste & Company report a very large demand for their switches. In the month of July alone they turned out 2,500 switches, and three weeks ago they were 1,700 behind their orders.

The Atlantic City Electric Railroad will be run the year round, using open cars in summer. The electric railway business is booming throughout the State, and contracts for new cars and roads are being made all the time.

Messrs. Walker & Kepler have been awarded the contract for installing a 250-light plant in the Wm. Cramp Ship and Engine Building Company to light up their works. The Edison dynamo will be run by an Armington and Sims engine.

Mr. A. J. De Camp has added to the United States system here 400 h. p., and to the Brush 300 h. p. this summer. All the belting used in these central stations is manufactured by Alexander Bros., of this city, who also have a leather belt which is waterproof, having run the same under water for forty-eight hours without the slightest injury.

Messrs. J. W. Queen & Co. report that they have just received very large invoices of the famous Ayrton and Perry ammeters and voltmeters. They will be able to fill the demand for instruments, which has been so great that during the past months they have been unable to cope with it. They have also received invoices of Carpentier voltmeters and ammeters and Cardew instruments.

Murray & Co., the glass manufacturers, have resumed operations for the season of 1889-90, and with large capacity they are enabled to ship all orders promptly. During the season improvements have been made, and the capacity for fine colored arc and incandescent globes and shades has been increased. They trade in only fine goods in all the various lines of globes and shades for arc and incandescent purposes.

Mr. H. G. Clay, Jr., the Philadelphia agent for the Thomson-Houston motors, reports installing the following machines, putting in the wiring, belting and shafting complete in every case instead of subletting portions of the same, as is so frequently done. His system has the advantage of making one party alone responsible for the whole plant. Wm. H. Walmesly, who deals in photographic apparatus, 1 h. p.; J. C. Kerr, 1 h. p.; Wall, Oaks & Co. 2 h. p.; Ivan Fox, 2 h.p.; Bonschur & Holmes, 1½ h. p.; The Electro Tint Engraving Company, 1 h. p.

Partrick & Carter, of 114 South street, have just issued a handsome and massive catalogue of electrical goods and supplies of all kinds. It consists of no fewer than 200 pages, well illustrated, in which the apparatus, etc., is carefully classified, and its merits are well set forth. Formerly Partrick & Carter issued two catalogues, but in this they are neatly combined. They have also prepared a trade sheet, applying to both divisions of the catalogue, and the whole will be sent to those who forward their business cards as evidence that they are entitled to trade prices. It is a fine catlogue and all should have it. W. F. C.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
39 Mallers Building, Chicago, Aug. 3, 1889.

The Ironwood Electric Company has been formed at Ironwood, Mich; capital, $5,000.

J. W. Macrum, of the Novelty Manufacturing Company, Denver, Col., is visiting Chicago this week.

Charles D. Jenney, Indianapolis, will have 10 motors on exhibition at the St. Louis Exposition.

The City of Superior has signed contracts for a complete installation of the Gamewell fire alarm and telegraph system.

George Cutter, Chicago, reports prospects very bright, numerous orders for light and power supplies having been received.

Mr. E. H. Hill, formerly of Detroit, now has charge of the Chicago office of the Pumpelly Storage Battery Company.

Club Notes.—R. M. House has been appointed manager of the Chicago Electric Club, and the office of custodian has been abolished.

W. N. Gray, Cincinnati, has secured the agency of the Perkins lamp for the States of Ohio, Indiana, Kentucky and West Virginia.

John H. Reid, Chicago, has closed contracts for placing a Mather incandescent plant of 2,100 lights in the Endicott Block, St. Paul, Minn.

The St. Louis Electric Exhibit.—The work of installing electrical apparatus at the St. Louis exposition must begin not later than Aug. 10.

The Sandusky Street Railway Company will probably select the Thomson-Houston electric system when changing their motive power.

The Decker Electric Company, Detroit, have just completed a static electric machine containing four 1½ gallon jars and six 36-inch plates.

The Pumpelly Storage Battery Company are preparing a set of cells of 500 ampere hours capacity for the Western Electric Company, Chicago.

James D. Randall, Memphis, has already placed in residences some four hundred of the push buttons illustrated last week in THE ELECTRICAL WORLD.

Minott Tirrell, Omaha, has disposed of his entire interests in the New Omaha Thomson-Houston Electric Light Company, and will probably locate in Chicago.

Charles E. Carpenter, Minneapolis, is preparing an electric cooking device, to be used in Taylor's restaurant, the current to be supplied from the Edison station.

The Elgin Telephone and Electrical Supply Company have recently fitted up handsome offices and store room in the American Express Building, Elgin, Ill.

The Municipal Electric Lighting and Power Company, St. Louis, are endeavoring to have 400 lights in operation during the festivities at the exposition.

T. P. Conant, formerly of the firm of Hood & Conant, Chicago, has accepted an important position under H. Ward Leonard, general manager of the Edison United Manufacturing Company.

The Wausau Electric Company has been formed at Wausau, Wis.; capital, $10,000; incorporators, F. M. Smith, James Montgomery, W. F. Collins, C. J. Winton and C. W. Harger.

Pittsburgh.—The Pittsburgh *Dispatch* says: The arc lights so far put up in Pittsburgh are such an immense improvement on the old plan of gas that they should be extended forthwith to all parts of the city.

The M. W. Simons Electric Company has been formed at Plymouth, Ind.; capital stock, $25,000; incorporators, Milliard W. Simons, Perry A. Randall, Orlando M. Packard, Albertus Caprin and R. T. McDonald.

Fort Scott, Kan.—The Mayor and Common Council of Fort Scott, Kan., visited the Excelsior Electric Company's large arc light station at Kansas City this week, being piloted around by R. J. Randolph, of the Chicago office.

W. G. Halm, vice-president and manager of the Perkins Lamp Electric Supply Company will transfer his headquarters to the factory, at Hartford, Conn., next month, having thoroughly covered the Western territory with agents.

Edward Laselle, president of the Southwestern Electrical Supply Company, Kansas City, has removed the office of the company to Rooms 910 and 911, New York Life Insurance Building. The warerooms still remain at 1,304 St. Louis avenue.

Mr. Adrian Hill, of North Anderson, Ind., has the drawings and models of an electrical railway which he claims will eclipse anything heretofore presented. Mr. Hill formerly resided in Jersey City and is now endeavoring to raise a stock company.

The Phœnix Incandescent Lamp Company, Chicago, have removed to 13, 15 and 17 North Jefferson street. This change was rendered necessary by the constant increase in orders, and sufficient machinery will now be added to allow a daily output of 800 lamps.

The Sandusky, Ohio, Electric Light Company will shortly install an additional 1,500-light Westinghouse alternating machine, as they have been running full capacity for some time. They recently wired the Soldier's Home for 1,200 Westinghouse incandescent lamps.

An Eddy Electric Motor is employed at the Altoona shops of the Pennsylvania Railroad in boring out locomotive cylinders. There are now being installed at their shops two 50-light Schuyler arc machines and an Edison incandescent plant, all to be in charge of W. H. Markland.

Webb C. Hayes, of the National Carbon Company, Cleveland, Ohio, visited Chicago this week. All the electrical fraternity are anticipating the receipt of the National Carbon Company's directory, that proved so useful last year. Mr. Hayes states that the revised edition will be ready next week.

W. Preston Hix, general agent of the Edison Company, made an able speech before the Milwaukee Common Council on Monday evening. Mr. Hix stated that the Edison-Villiard Illuminating Company have invested $325,000 of the $500,000 required to complete the plant, the remaining $175,000 being taken by local capitalists.

James I. Ayer, superintendent of the Municipal Electric Lighting and Power Company, St. Louis, Mo., has some two hundred men at work on construction work, and expects to have the city lights burning on Jan. 1. Simplex wire will be used on the overhead lines, but no selection has yet been made of the insulated wire to go in the conduits which are now being laid by the St. Louis Subway Company.

The Sperry Motor Company has been incorporated at Chicago to manufacture electric and other motors and furnish power and heat; capital stock, $50,000; incorporators, Elmer A. Sperry, David T. Foley and William R. Goodman. A constant current motor, designed by Mr. Sperry for use on arc circuits, which has given good satisfaction under severe tests, will be manufactured and placed on the market by this company.

Mr. C. A. Brown and Col. George Beetle, of the Western Electric Company Chicago, will be in attendance at Niagara Falls. Mr. Brown is distributing some handsome paper weights fashioned from sections of Patterson cable, having a wooden base so arranged that no scratching of desk surface can occur. As stated a short time since, their orders for this cable has taxed their capacity to the utmost, necessitating the building of an additional wing to their factory.

Telephone Quotations.—Col. S. G. Lynch, broker, 146 La Salle street, Chicago, furnishes quotations on telephone stocks as follows:

Chicago	$310@$325	Cumberland	$ 69@ $70
Central Union	59@ 60	Wisconsin	117@ 118
Michigan	84@ 85	Bell of Missouri	151@ 153
Great Southern	31@ 33	Iowa Union	23@ 25
Colorado	38@ 40	Missouri and Kansas	65@ 75
Rocky Mountain Bell	41@ 42		

A Great Storm.—Chicago experienced her greatest storm last Saturday evening, between 7 and 10. The dynamos in many of the hotels, theatres and public buildings were stopped either through the rush of water into the engine rooms, the wetting of belts or, in one or two cases, the flooding of the dynamos with water. The storage battery people are showing how little inconvenience would have been experienced if each hotel and theatre had only held in reserve a set of storage cells charged for just such an emergency.

The National Railway, Electrical and Industrial Association, St. Joseph, Mo., will have the driving engines in operation about one week previous to the opening of the exposition to the public, and exhibitors of machinery in motion will be required to have their machinery in running order three days before the opening of the exposition, Sept. 3. The line-shaftings, from which power will be furnished to exhibitors on the first floor, are 2 15-16 inches in diameter. These lines will be driven at a speed of 200 revolutions per minute.

General Activity.—The Electrical World of July 27 contained an editorial on the activity displayed in electrical circles. Commenting thereon, Mr. G. E. Palmer, manager of the Chicago office of the Babcock & Wilcox Company, says: "Usually we can clean up all our orders by the end of the year, and to enable us to continue doing so we doubled our capacty; but January found us 16,000 h. p. behind our orders, and to-day we are over 25,000 h. p. behind, and plans are now being drawn for again doubling the capacity of the entire plant. We expected and prepared to do a great business, but the actual demand has been unprecedented."

The Thomson-Houston Electric Company, through their Chicago house, have sold the following electric light plants during the past week: Brookfield, Mo., Electric Light Company, 50 arc; Knox, Hill & Co., Warsaw, Ill., 150 incandescent; Thomson-Houston Electric Light Company, Meridian, Miss., 75 arc; Sawyer, Goodman & Co., Marinette, Wis., 150 incandescent; Carbon Light Company, Louisiana, Mo., 30 arc; Hammond, Ind., Electric Light Company, 35 arc; Armour & Co., stock yards, Chicago, 650 alternating incandescent. Theodore P. Bailey, of the railway department of the Thomson-Houston Electric Company, has returned from the East and Mr. W. J. Clark, who was temporarily in charge of the office, has again taken up his route book. The electrical fraternity of Chicago would gladly welcome Mr. Clark to their permanent membership, and regret his departure.

Electrical Supplies.—The cream of the trade in electrical supplies is captured by the company that is in a position to make prompt shipments on the largest orders. To successfully accomplish this requires the investment of considerable capital, the value of the stock and accounts in the leading houses approximating a total of $100,000. The demand for supplies being constant, especially in heavy goods, due to the numerous installations of electric light, power and railway motor plants, fair prices with reasonable profits are secured. Two years ago a supply house was opened in Chicago in a quiet way, occupying only one floor in the second story of a building on La Salle street. By careful attention to business and courteous treatment of customers, the business of that house rapidly outgrew its original quarters and for some months it has occupied an entire building of four floors and basement and in addition thereto a portion of a warehouse for storage purposes. The basement is filled with heavy goods; the retail department and shipping room occupy the first floor; the officers are in the front half of the second floor, where there is an abundance of clear light, the remainder of the floor being taken up by electric light carbons and similar goods; magnet and underwriter's wire and goods of lighter weight fill the third floor, while the fourth is stored with the smaller Okonite wires, tapes, tubing, etc., the heavier Okonite cables being placed in the basement. The marked progress made by this concern, the Central Electric Company, from the day its books were opened in Chicago, entitles its managers to much credit.

F. De L.

Tacoma, Wash., July 15, 1889.

An Electric Railroad.—Some months ago note was made of the fact that the Sprague Company had secured a contract for putting in an electric road in this city. After the contract had been made Nelson Bennett, the owner of the street car system, sold a controlling interest in the road to a syndicate composed of Henry Villard, Paul Schulze and D. H. Lauderback, at one time general manager of the Chicago Edison Company, a large holder of Central Union Telephone stock, and, back in 1881, business manager of the Western Electric Company. The new company proposed extending the lines of the company, and making great improvements. The City of Destiny is terraced upon bluffs, the highest of which is about 300 feet above the level of Commencement Bay—an arm of the Sound. The company proposed to use the electric system of street car propulsion on the streets parallel with the bay, and to put in the cable system upon two of the principal streets leading directly up the hill. These streets are very steep, rising probably 200 feet within a half mile and upon certain sections the grade is 14 per cent. Inasmuch as the tracks during the rainy weather in winter would be covered with the mud washed down from the higher levels, it was thought that the electric motor or any other form of motor depending upon its own weight for adhesion to the rails would not serve the purpose, and for this reason it was proposed to put in the cable system. But now the company has given up the cable, for the present at least, and will use electric power in climbing the hill.

Mr. G. H. R. Preble, constructing engineer for the Sprague Company, has been at work some weeks here setting the poles for what is known as the Old Town line and the Pacific avenue line. Within 60 days these lines will be running cars propelled by electricity. The power house is being built.

The Water and Light Company are furnishing the electric lighting of the town. They are running Thomson-Houston arc dynamos and an Edison municipal dynamo. The arc light service is very satisfactory.

Superintendent Sands, of the local office of the Sunset Telephone and Telegraph Company, is driven by customers in want of telephones. He is constantly behind his orders, through no fault of his, however. He is now grappling with the induction problem, which has developed itself in every city or town where telephone and electric light lines are found in proximity to each other on polcs. He is bright and thoroughly understands his business, and will doubtless arrive at a satisfactory solution of the difficulty.

Isolated Lighting.—There has been some demand here for independent installations of the electric light. The tremendous growth of Tacoma within a year and a half has greatly stimulated building, and a number of fine business blocks are now going up. There has also been a move toward putting up fine residences, costing all the way from $2,500 to $20,000 each. In these the minor applications of electricity, such as bells and annunciators, are to be found, and in several wiring has been done for the electric light in anticipation of the time when the low tension system is extended to them.

Tacoma offers the same advantages to dealers in electrical supplies and construction companies that it does to other departments of industry. It is the terminus of the Northern Pacific road, and will supply the interior towns which are springing up so rapidly. It is also the head of navigation and will supply all the cities and towns between it and the Straits of Zuca, leading to the broad Pacific. T.

ENGLISH NOTES.

[*From Our Own Correspondent.*]

London, July 3, 1889.

King, Brown & Co., v. The Anglo-American Brush Corporation.—As I cabled last week, the action of King, Brown & Co, v. the Anglo-American Brush Corporation, has resulted in Brush's patent, No. 2,003, of 1878, being invalidated, thus upsetting the claim of the Brush Company to a monopolv of the compound winding principle. It is needless to say that this decision of Lord Trayner in the Court of Session at Edinburgh has been appealed against and it remains to be seen whether it will stand a review in a higher court. Lord Trayner commenced his judgment, which, I may remark, was a model of clearness and conciseness, by stating the question at issue, namely, whether Mr. Brush was, or was not the inventor of (1) a peculiar form of commutator; (2) series-shunt winding. The claim for a commutator with "metallic wearing sub-segments detachably attached" I may briefly say, was invalidated by reason of the invention claimed in the final specification being larger and different from that claimed in the provisional specification. The learned judge then proceeded to deal with the far more important claim for compound winding. "For the pursuers," Lord Trayner went on to say, "it is maintained that Varley disclosed and published the invention of a series-shunt machine in his specification and patent of 1876, and constructed a machine in conformity with that specification which was publicly used in 1877. The defenders' scientific witnesses all express the opinion that Varley did not disclose the series-shunt arrangement. The value of these opinions, however, is seriously diminished when consideration is given to the method by which they are reached. Their method is to take Varley's description paragraph by paragraph, each by itself and detached from the context, and then proceed to show how each separate paragraph is, when so read, inconsistent with, or suggestive of, something other than series shunt. To do justice to Varley's description, it must be read in its entirety." Reading it in its entirety Lord Trayner ruled that Varley's description comprises every distinctive feature of a series-shunt machine." To the arguments of the defenders that no ordinary skilled workman could have constructed a series-shunt machine from Varley's specification, the learned judge says that even if this were so, it would, by no means, decide the question in the defenders' favor, since "a specification may so insufficiently describe the process or machine patented as to render the patent invalid. *It may, nevertheless, contain sufficient description to disclose or publish the invention, so as to prevent its being validly patented by another subsequently.*" Lord Trayner, however, ruled that it had been demonstrated that Varley's description *was* sufficient to enable a workman to make his machine. The question whether Varley had, in 1876, any knowledge of the value of compound winding was, Lord Trayner, said, without any direct bearing, "Lastly I have to notice," the learned judge proceeded to say, "that the defenders rely very much upon the fact that Varley in his specification did not claim the invention of compound winding. But the fact that Varley did not claim a certain invention is no proof that he did not publish it." In conclusion Lord Trayner held that Varley's machine was most decidedly not an experimental one, but was applied for business purpose, and he therefore ruled "that the defenders' machine was anticipated by Varley's, both by publication and use, and that the defenders' patent is consequently invalid." In this decisive way ends another chapter in electrical litigation in this country. At present things stand somewhat as follows: The incandescent lamp and Gaulard-Gibbs transformer patents, are waiting to go before the House of Lords; the compound winding patent has been invalidated, but the decision is appealed against; the laminated iron armature patent is about to be contested. If no one else in England can make a living out of electric lighting, the legal profession at least manages to do so.

Telephone Amalgamation.—Public attention is still being directed to the action of the Postmaster-General in warning the telephone companies as to the possible consequences of their projected amalgamation, the weekly journals as well as the daily newspapers having most of them something to say on the subject. Many of the articles are confessedly inspired by the companies, and the facts are naturally made to square with the arguments; but in spite of the general tendency of the press to go against a public department, a not inconsiderable number of pronouncements have been made adverse to the companies, and in favor of interposition, the fact being that the telephone companies, or at all events the chief of them, have not made their systems sufficiently cheap and efficient to be popular. The main interest, however, of your readers probably centers on the question whether the government will or will not buy up the telephone system outright next year, as the terms of the license entitle them to do. Without venturing to predict anything positively on this point, one may safely indicate the probabilities arising out of the situation as it stands at present. And first, it should be noted that the companies make no secret of their desire to cover the whole country with a consolidated telephone corporation, to guard against the time, two or three years hence, when their patents will expire and they may be exposed to unrestricted competition. Further, the scheme of amalgamation involves the creation of fictitious stock for the purposes of acquisition, the shares of the purchased companies being treated as so many more shares in the purchasing company, or vice versa, the result being a veritable watering of capital, but an ostensible increase of it so as to largely augment the seeming value of the property in case the Postmaster-General shall exercise his right of purchase. This right arises next year, and again seven years later, and finally in 1904. In short, the two-fold object of this move is to guard against the consequences of the patents expiring if the government do not purchase, and to enhance the price to be paid if they do purchase.

The countermove of the Postmaster-General is equally simple; he does not mean to pay a fancy price for property which is legally his by reversion (at a fair price) in any of the years named above, and he will treat as of no effect anything the companies may now do to either force him to pay more or to deprive the country of the legitimate competition to which it is entitled under the licenses granted to the existing companies. The United Telephone Company which is the parent of all the subsidiary companies, affects to believe that the license permits amalgamation, and relies upon a tacit understanding that the business would not be molested by the government, so long as it was conducted properly. But the terms are explicit against any assignment or sale without the Postmaster-General's consent, which he withholds: and as to the understanding, it is no longer binding if the companies set up a state of affairs which was not only not contemplated when the promise was made, but was expressly guarded against in the legal documents drawn up at the time. Here, then, the question arises, what will the companies do; and it is somewhat obscured by the fact that their real wishes are not publicly known, some people suspecting that they want to be purchased, and quickly. If not, they will abandon the amalgamation project, endeavoring to work together connectedly, as the old telegraph companies did, without union. If they desire purchase, they will defy Mr. Raikes' warning and claim the privileges of martyrs when the inevitable consequences follow. As regards the other party, he will not be averse to playing the part of chief executioner, a rôle which he has sustained with considerable eclat in the recent purchase of the Submarine Telegraph Company's property. Such is the situation, and in order to form a correct opinion of subsequent stages in the comedy your readers have only to remember one dominating fact, namely, that in this country a telephone is by law a telegraph, and by right belongs to the State, being worked by private companies only as an act of grace, and on payment of heavy royalty for the privilege.

THE TELEGRAPH.

T. M. B. A.—An assessment, No. 232, for August, for $1, has been made to meet the death claims of W. H. Weed, F. W. Hirst and J. K. Polk.

THE ELECTRIC LIGHT.

Brownsville, Tex.—A company is being organized by Mr. H. F. Gray, of Galveston, to put in a $15,000 plant.

Toronto, Can.—An office for the Fort Wayne Jenney Company has been opened by Messrs. W. J. Morrison and T. Cooper.

Salt Lake City.—It is proposed to light the city by electricity instead of gas, also to put in an electric fire-alarm system.

The Standard Electric Light Company of Hartford, Conn., has been incorporated under the laws of West Virginia.

Burlington, Wis.—The Burlington Edison Electric Company has been formed with a capital stock of $15,000 by L. J. Smith, H. Wagner, Jr., and B. Brehm.

San Pedro, Cal.—The San Pedro Light and Power Company has been formed by H. H. Kooser, E. W. Clayton and others with a capital stock of $1,000,000.

The R. F. Electric Light and Power Company has been formed in Boston with a capital stock of $5,000. Mr. C. H. Whitney is President, and Mr. J. L. Faxon is treasurer.

The Mohawk Valley Electrical Company has been formed by W. G. Schermerhorn, B. A. Shear and others, with a capital stock of $200,000, to operate in Schenectady and Niskayuna.

Savannah, Ga.—The Mutual Electric Light Company has been formed with a capital stock of $50,000, by H. Blum, D. Douglass, B. A. Denmark and others, and will put in plant at once.

Tarrytown, N. Y.—The Tarrytown Union Electric Light Company has been formed with N. H. Odell as president, D. Silver, vice-president; O. F. Odell, treasurer, and C. H. Curtiss, secretary.

Red Bluff, Cal.—The Red Bluff Electric Light and Gas Company has been formed with a capital stock of $100,000. Mr. J. S. Cone is president, and L. C. Granner, secretary and general manager.

The Brookfield, Mo., Electric Light Company have purchased a new steam plant, consisting of a 70 h. p. Ide automatic engine, boiler, etc. The contract was awarded English, Morse & Co., engineers and contractors of Kansas City, Mo.

Toronto, Can.—The Toronto Electric Light Company is starting 100 new street arcs and building the plant for 300 more. The company, of which Mr. J. J. Wright is superintendent, have 500 city lights under contract, and run nearly 900 in all. They have put in a new 250 h. p. engine and two 100 h. p. boilers.

The Largest Catholic Church.—The Notre Dame church, located in the Place d'Armes, Montreal, Canada, is probably the largest on this continent. It is a beautiful structure, in the form of a parallelogram, the architecture being of the Gothic style. The building, which was five years in course of construction, is 241 feet long, 135 feet wide, 61 feet from foundation to eaves, and will seat from 10,000 to 12,000 people. It has recently been decided to light this church throughout with electricity, and an isolated plant for that purpose is now being installed, the Royal Electric Company, of Montreal, furnishing the dynamos, lamps and other electrical apparatus, the design being to light partly with arc lamps and partly with incandescent lamps. The contract for supplying the engines to drive the dynamos has been let to the Woodbury Engine Company, of Rochester, N. Y., and calls for two of their 60-h. p. high speed type. It is the intention of the church authoritie

to make this one of the finest lighting plants in the Dominion, and naturally enough the Woodbury people feel highly gratified at the selection of their engines.

APPLICATIONS OF POWER.

Atlanta, Ga.—The Fulton County Electric Street Railroad is being built.

Concord, N. C.—An electric road is to be built to run to Mt. Pleasant. Mr. J. P. Allison is interested.

Hamilton, O.—The Hamilton Street Railway and Electric Company has been incorporated with a capital stock of $100,000.

Niagara Falls.—An electric road is to be built at Niagara Falls, on the Canada side, starting just above the Clifton House and running to Queenston Heights.

Indianapolis.—The Chicago owners of the Indianapolis street railway system have secured an ordinance for an electric railway connecting the city with the suburb of Brightwood, and it will be put into operation as soon as possible.

PERSONALS.

Mr. Robert Grimshaw will present a paper at the Paris Congress of Applied Mechanics on improvements in the steam engine since 1878.

Mr. A. C. Smith has been given the general selling agency for the entire output of the Non-Magnetic Watch Company of America, whose watches, made under the Paillard patents, are now so well known.

Col. R. D. Hazard has sent to Mayor Grant from London a map or sketch of four of the London underground lines, where provision is made for pipe and wire galleries, in the way for which the Mayor had expressed a preference.

Mr. John J. Wright, the electrical engineer of Toronto, has a steam yacht that is described as replete with electrical novelties and conveniences. One feature is that the engine room gets its signals by white letters operated electrically, instead of by gong.

Mr. W. A. Vail, the general superintendent of the Metropolitan Telephone and Telegraph Company, has resigned to take charge of the Boston superheated water plant. Mr. Vail's new position is one of large responsibility. It is a matter of extreme regret to his friends that he leaves New York.

Mr. Walter T. Glover and Mr. H. Edmunds, of the well known English firm of Walter T. Glover & Co., left for England on Saturday, Aug. 3 on the "Umbria." Mr. Edmunds has happily recovered from his recent illness, and the sea trip will no doubt set him on his feet. Mr. Glover proposes to attend the Paris Electrical Conference.

Mr. Abram Van Winkle, of Hanson, Van Winkle & Co., Newark, N. J., and 92 Liberty street, has just returned from an extended tour through Great Britain and the continent, looking into the business of manufacturing specialties for electroplaters, electrotypers and the deposition of metal. The house have been engaged for years in the business, and their "Little Wonder" dynamos are widely known and used, as well as their tools, anodes, etc.

MISCELLANEOUS NOTES.

The Thomson-Houston Exhibit at Paris is well described and profusely illustrated in the English *Engineer* for June 28. The article gives an accurate and appreciative account of all the apparatus shown.

Non-Magnetic Watches.—The Chicago, Burlington & Quincy Railroad Company have recently issued an order to all their conductors and engineers, requiring them to use only the best non-magnetic watches.

The Kemmler Investigation has been resumed by Referee Becker at Buffalo. Among the witnesses was Dr. G. E. Fell, who experimented with dogs in 1887 and who believes that a current in the neighborhood of 1,000 volts is the sure thing.

New Orleans.—A department in Tulane University has been devoted to electrical study under Prof. Brown Ayres, and is working successfully. The laboratory is well equipped, some $12,000 having been spent lately in the purchase of instruments, etc.

Electricity in Mining.—The summer meeting of the Ohio Insititute of Mining Engineers is to be held at Cambridge, O., on Aug. 7, 8 and 9, when Mr. H. M. Schlesinger, the electrical engineer, will bring the subject of electricity in mining before the society.

Test of the Tripp Anti-Friction Journal Bearing.—A successful dynamometer test of the Tripp anti-friction journal bearing was made on July 29 in the yard of the New York & New England Railroad, Boston, by J. B. Henney, supt. of motive power, and other officers of the road, and in the presence of representatives of the Thomson-Houston Company and others. The test on the cars numbered 150 and 156 of the master car-builders' standard journal showed a draughting strain of 600 and 800 pounds respectively, and on the twelve-wheeled Pullman car Calypso a strain of 700 pounds, averaging for the three cars 700 pounds. Car 158, with Tripp bearings, commenced running Jan. 28 last, and was guaranteed to run over one year without any attention or additional lubrication, and has now run over 18,000 miles. This car was moved with a strain of 250 pounds, showing a saving of power of over 60 per cent. in favor of the Tripp bearings.

BUSINESS NOTICES.

All Electricians who *are using* or *have used* Schieren's electric perforated belts say that they "take the cake" for running on dynamos.

The Woodbury Engine Company, of Rochester, N. Y., have issued a tasteful little brochure, calling attention to the fact that they use the flat valve in their high-speed engines, and contrasting it favorably with valves of the piston type.

Perforated Belts run *smoother*, with *less* strain on *dynamo bearings*, and with the use of *less oil*, than any other belts made. They also *prevent air cushions*. Chas. A. Schieren & Co. (Manufacturers), New York, Chicago, Boston, Philadelphia.

Battery Cut-Out.—Attention is called to a simple device for disconnecting gas-lighting batteries if accidently grounded. It is cheap, sensitive, never needs watching, and has no clockwork to be kept wound. Terms furnished by the Electric Supply Company, of Syracuse, N. Y., No. 105 South Warren street.

Jerome Kidder Manufacturing Company, New York City.—I have used nearly all the different batteries made. Yours excels them all for an even and reliable current, and will outwear twice over, the best of them. I know, whereof I speak. Truly yours, E. A. Tift, M.D., Toronto, Canada.

The Shultz Belting Company, of St. Louis, Mo., have lately issued a new edition of their excellent pamphlet on the selection and management of machine belting, including also useful tables for determining the width of belt and horse power. A large number of testimonials are included. Mr. A. B. Laurence, of 1a Platt street, is now the New York manager for the company, and is doing well.

Patterson, Gotfried& Hunter (Limited), 146-148 Centre street, carry a complete stock of Brush copper, celluvert fibre, oiled paper, hard rubber, rod and sheet brass, brass, copper and iron wire, self-hardening tool steel, set and cap screws, machine bolts machine and wood screws, taps and dies, files and twist drills blowers and forges, machinery, tools and hardware, gear wheels wood pulleys, shafting hangers and belting. General factory supplies.

Henry R. Worthington, the celebrated pump-builder, of 86 and 88 Liberty street, has issued, in parallel English and French, a sumptuous pamphlet relative to the work done by his pumps at the Paris Exposition. The pamphlet is most beautifully illustrated. He issues also a plan of the Exposition, indicating thereon, by red flags, the numerous Worthington pumping plants. There are eleven different installations, and no fewer than twenty-three Worthington pumps, including a 6,000,000-gallon high-duty engine.

The Woodhouse & Rawson Electric Supply Company, of 11 Queen Victoria street, London. Eng., have recently placed upon the market the Fairbairn patent sight feed lubricator. This apparatus is perfectly independent, and can be applied to any bearing surface. The position of a rod placed above the cup clearly indicates to an attendant at a distance the amount of oil contained in the lubricator. An adjustment screw permits of accurate regulation of the flow. The same firm have also brought out the "Diamond" patent oil filter, which is very simple in construction and easily operated.

Standard Resistance Box and Bridge.—James W. Queen & Co., of Philadelphia, are now making and selling the excellent resistance set devised by Prof. W. A. Anthony, and first introduced to public notice in the columns of THE ELECTRICAL WORLD. Prof. B. F. Thomas, of the Ohio State University, speaks highly of the apparatus, and says: "It adds not a little to one's satisfaction in using this fine piece to know that we owe it wholly to American ingenuity and skill." Besides making the Anthony instruments and many others, Queen & Co. will calibrate apparatus. Each instrument tested is furnished with a certificate from Prof. Anthony, showing the corrections to be applied.

SCHERMERHORN BUILDING,
96 Broadway, New York, July 24, 1889.

Anglo-American Electric Light Mfg. Co.

DEAR SIRS: I take pleasure in indorsing the work of your battery put in this building May 20.

In every respect it has exceeded the claims made for it, and is saving us two and one-half hours running of engine and dynamo each day, a half a ton of coal each week, and our gas bill is reduced proportionate to the amount of lights we are wired for.

We have never had the slightest trouble with it, and we have taken from it its rated capacity every night for the past thirty-three days, and on Sundays from thirty-three and a third to fifty per cent. in excess.

Very truly yours,
(Signed) JOHN STORER, Superintendent.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

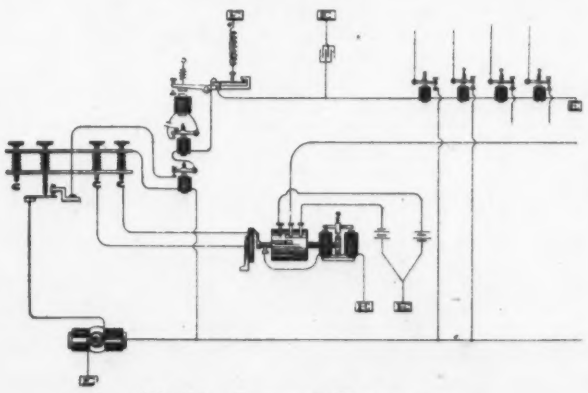
PATENTS ISSUED JULY 23, 1889.

407,327. Electric Generator; Charles E. Buell, of Newark, N. J. Application filed Feb. 18, 1889. An electrical generator comprising an exterior circuit and a condensing circuit, gears for actuating the same, and electrical connections with the gears, the gears being adapted to first complete the condensing circuit and then break the circuit, whereby the generator is caused to discharge into the exterior circuit.

407,414. Electric Meter; William McKinney, of Schuylkill Falls, Pa. Application filed April 19, 1889. Consists in the combination of an automatic and electrically operated stop and starting device with a lever-operated clock movement for operating the hands on two, three, or more dials, to record the time a current is flowing over the wire that controls the clock movements.

407,416. Station and Want Printer; Major Dane Porter, of Brooklyn, N. Y., Assignor to the Porter Teletype Company, of New York. Application filed May 11, 1888. The combination, of a series of independent controlling circuits, a rotary type wheel controlled in common by said circuits and bearing characters corresponding to the designation of the circuits, a want or message-printing wheel, a transmitter therefor placed in each of the independent circuits, and having a series of keys adapted to act upon the circuits at different points in the revolution of a circuit-closing arm connected with said circuit, an actuating or controlling magnet for said circuit-closing arm and a pulsator connected with the driving mechanism for the message wheel.

407,447. Underground Electric Conduit; Edward H. Phillips, of New Haven, Conn. Application filed June 17, 1889. A conduit section consisting of a metal shell and a lining com-



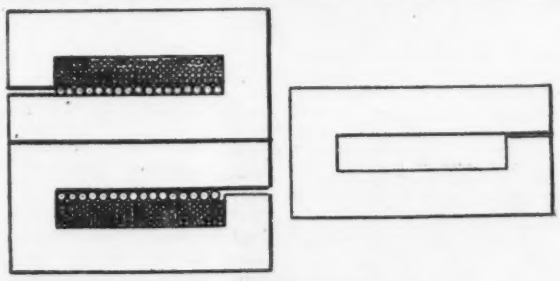
407,729. PRINTING TELEGRAPH.

posed of hydraulic cement, silicon, silicate of sodium, and an hydrous calcium sulphate or its equivalent.

407,454. Lightning Arrester; James W. See, of Hamilton, O. Application filed Feb. 18, 1889. In a lightning arrester, the combination of a cylindrical plug of insulating material, a pair of binding posts rigidly attached thereto, and a pair of metallic springs mounted on said block and adapted to make contact with each other and connected one to each of said binding posts.

407,455. Electric Cut-Out; Adolph T. Smith, of New York, N. Y. Application filed Jan. 30, 1889. The invention consists in an electric cut-off which comprises a receptacle for sand or other suitable material, a valve for closing the bottom opening of the same, and an electro-magnet in the gas-lighting or other circuit, the armature of which operates said valve, so as to open or close the bottom opening of the receptacle, a fulcrumed contact lever having a funnel at one end and a weight at the opposite end, a pivoted and weighted contact lever provided with a stop shoulder for the fulcrumed contact lever, means for setting said levers in contact with each other, and a receiving funnel located vertically between the funnel of the fulcrumed contact lever, so as to collect the sand discharged, and return it from time to time to the main receptacle.

407,461. Automatic Telegraphy; Frank Anderson, of Peekskill, N. Y. Application filed Feb. 9, 1889. An automatic telegraphic receiver consisting of a record roll or supply of sensitized paper or equivalent material, with feeding mechanism for advancing said record paper according to the demands of the transmitting apparatus, and a series of independent receiving



407,618. CORE FOR CONVERTERS.

styluses connected to a wheel, said styluses being insulated from each other, and having electrical connections for bringing them successively into circuit as the wheel is rotated.

407,462. Automatic Telegraphic Recorder; Frank Anderson, of Peekskill, N. Y. In an automatic telegraphic receiver of the Page type, a message blank having marginal lines, in combination with a receiving recorder having a series of pens connected to contacting surfaces insulated from each other, and electrically connected by a two-point contact spring to the distant transmitter, the contacting surfaces having a fixed relation to the distance between the two marginal lines, whereby the characters near the ends of the successive lines are repeated.

407,470. Circuit for Electric Railways; Henry H. Cutler, of Newton, Mass. Application filed April 13, 1889. A circuit for an electric railway, comprising two conductors or main leads connected with opposite terminals of the generator and placed in proximity to one another, whereby each neutralizes the disturbing effect of the other upon adjacent lines, and a contact surface or conductor made in short sections electrically insulated from one another, but with each of said sections connected with one of said main conductors.

407,473. Electro-Galvanic Belt; Alonzo Dow, of Wooster, O. Application filed April 11, 1889. In an electro-galvanic belt, a cell consisting of two metallic plates and an interposed absorbent pad, which are united together by transverse fastenings, each plate having an integral tongue that if folded or doubled on the plate and arranged on the inside of the cell adjacent to the absorbent pad, the tongue of one element of the cell forming an eye at one end of said cell, and the tongue of the other element forming an eye at the opposite end of said cell.

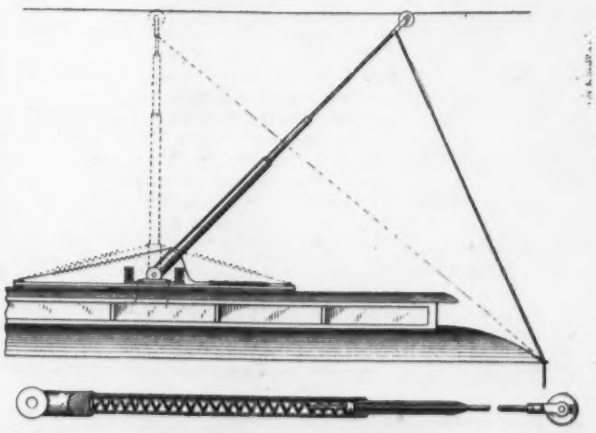
407,480. Relay for Quadruplex Telegraphs; Clarence L. Healy, of Brooklyn, N. Y. Application filed Sept. 15, 1888. For description see page—this issue.

407,490. Electric Signal; George McIntosh, of Stonington, Conn. Application filed April 20, 1889. The improvement relates to apparatus for automatically giving an audible signal upon a steamboat or steamship during fog, or whenever from any cause it will be necessary to give such signal at stated intervals.

407,485. Multiple Wire System of Electrical Distribution; James Alfred Lighthipe, of Wilmington, Del., Assignor to Himself, George W. Bratton, of Philadelphia, Pa., and Henry Nunez, of New York, N. Y. Application filed April 25, 1888. The invention is designed to provide means whereby electric incandescent lamps or other similar translating devices can be arranged in multiple series in as many circuits as may be desired or as may prove economical under varying circumstances. To a certain extent the result is accomplished by what is known as the three-wire system of electrical distribution. This system is in extensive use and works efficiently within its limitations. It has been found, however, that when attempts have been made to increase the number of circuits beyond three, trouble has arisen from the fact that there was no way of controlling any of the series of lamps except the two upon the outside. Assuming, for example, that the lamps are arranged in three series, no way has yet been found for compensating for varying resistance in the inner series except within very narrow limits. The patent illustrates a system in diagram in which four rows or series of lamps are employed, and in which is maintained a perfect regulation of the lamps in each series. The whole constitutes a five-wire system of electrical distribution.

407,496. Electrical Railway; Sidney Howe Short, of Denver, Col., Assignor to the United States Electric Company, of same place. Application filed February 19, 1887. In an electrical railway, the combination, with a car, of a current collector within the conduit, a shoe for supporting the same, electrical connections to the car, and a driver between the driver and shoe, said driver having both ends forked and detachably connected to the car and shoe, the connection being adapted to be broken in case an obstruction is met with.

407,581. Selecting Telegraph, Mark W. Dewey, of Syracuse, N. Y., Assignor by Direct and Mesne Assignments to the Dewey Corporation of same place. Application filed Sept. 22 1888. In an electric telegraph comprising an electric circuit, a table of operative contacts at the receiving station, a corresponding table of contacts at the transmitting station, a transmitting instrument adapted to be moved in different directions and to different distances over the latter table, and an instrument adapted to operate the contacts on the table at the receiving station and electrically moved in unison with the transmitting instrument.



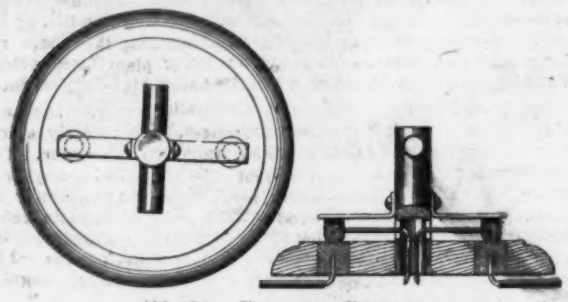
407,749. EXTENSIBLE UPWARD PRESSURE CONTACT ARM.

407,618. Core for Converters; Marmaduke M. M. Slattery, of Fort Wayne, Ind., Assignor to the Fort Wayne Electric Company, of same place. Application filed March 8, 1889. A compound plate for a converter core consisting of two thin flexible laminæ of iron, each with a central opening to embrace the wire coils and each slitted to one end to permit its being opened and placed upon, the coils the two laminæ to be laid one above the other with no insulation between them and with the slitted ends opposite each other. See illustration.

407,619. Electric Meter; Marmaduke M. M Slattery, of Fort Wayne, Ind., Assignor to the Fort Wayne Electric Light Company, of same place. Application filed March 14, 1889. An electric meter consisting of a fixed coil traversed by alternating currents, a second coil the circuit of which is closed upon itself fixed in inductive relation with the said first coil and with its plane intersecting the plane of the first coil, a moving part consisting of a closed electrical conductor free to rotate, placed in inductive relation with the two fixed coils aforesaid, a shunt coil in a circuit derived from points in the circuit of the first-named coil having a difference of potential between them less than that operating in the circuit of the first-named coil and superadded to said first-named coil and a retarding and regulating device and registering mechanism.

407,660. System of Protection from Lightning; Charles F. Hill, Hazleton, Pa. Application filed Nov 16, 1888. A system for protecting receivers of inflammable or explosive substances from lightning consisting of a cordon of poles located some distance from the structure, and having their upper ends extended above said structure; a metallic net suspended horizontally above the structure by the poles, and conductors connected to said net and embedded at their lower extremities in the earth.

407,673. Galvanic Shoe; John S. Mellon, of St. Louis, Mo., Assignor of six-tenths to G. W. Lewis, of same place. Application filed April 1, 1889. It consists in providing shoes and other foot



408,194. Electric Switch.

appliances with metallic conductors and generators of electricity or galvanism and connecting the human system there through with the ground, so that the electrical condition existing between the body and the earth may be kept in harmony with each other.

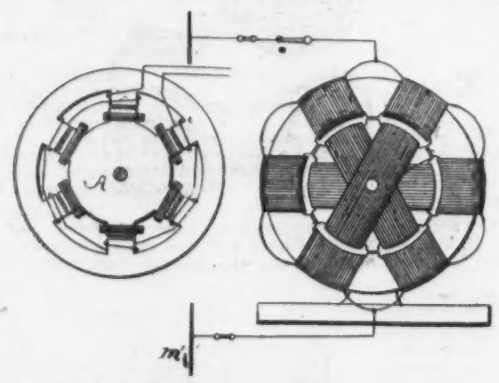
407,689. Charging Systems for Secondary Batteries; Andrew L. Riker, of New York, N. Y. A car or other vehicle having compartments all open at the side for the admission of batteries and transverse rails near the top of each compartment, in combination with a series of battery vessels having rollers adapted to run on said rails.

407,692. Autographic Telegraphic; James H. Robertson, of Rutherford, N. J., Assignor to the Writing Telegraph Company, of New York, N. Y. Application filed May 21, 1889. In an automatic telegraph, two groups placed side by side, of insulated conducting strips connected to the resistances in combination with a contact maker or circuit closer in the form of a stylus the contact points of which constitute the tracing points.

407,729. Printing Telegraph; Clarence L. Healy, of Brooklyn, Assignor to the Commercial Telegram Company, of New York, N. Y. Application filed Nov. 28, 1887. In printing telegraphs, the combination, with a repeating key circuit of a number of printing circuit relays located in a branch circuit, an artificial resistance located in another branch circuit, and a circuit controller shifting the repeater key circuit from the relay branch to the resistance branch. See illustration.

407,730. Printing Telegraph; Clarence L. Healy, of Brooklyn, Assignor to the Commercial Telegram Company, of New York, N. Y. Application filed Dec. 27, 1887. It has heretofore been possible for the key-board operator in transmitting for printers employing two independently rotating type-wheels to release the locked wheel at other points than the unison dot, thus throwing the wheel released out of unison. To avoid this it has been necessary that the key-board operator should always wait until the transmitter stops on the last letter or figure before depressing the unison dot key to shift to the other wheel. This necessity is annoying to the operator and causes some delay in transmitting, unless he fails to observe due care, which results in throwing the released wheel out of unison. This invention introduces an additional circuit controller for controlling the circuit of the shifting relays, which circuit controller is itself controlled at the unison dot segment of the sunflower as well as the key-board, so that the shifting relays are not affected until the trailing arm reaches the unison dot segment of the sunflower.

407,745. Electrical Railway; Sidney Howe Short, of Denver, Col., application filed April 15, 1887. An electric railway having a single conductor composed of sections of insulated wire, the



407,844. Alternate Current Electric Motor.

ends of the section being connected together by switches, a switch shifter for operating said switches, contact plates on the ends of the sections with the space between them and a suitable current collector.

407,749. Extensible Upward Pressure Contact Arm; Charles J. Van Depoele, of Lynn, Mass. Application filed June 7, 1889. In an electric railway, the combination with an overhead conductor and a moving vehicle, of a rigid arm hinged to the top of said vehicle, said arm being composed of a tubular section and a telescopic end section, carrying a contact wheel at its free end, and fitting into said tubular arm, and a spring within said arm acting against said end section and keeping the contact wheel normally against the conductor when the arm is moved upon its support. See illustration.

PATENTS ISSUED JULY 30, 1889.

(1) 407,761. (2) 407,762. (3) 407,763. Calelectric Generator; Edward G. Acheson, of Pittsburgh, Pa. Applications filed (1) April 16, 1889; (2) April 19, 1889; (3) June 18, 1889. For description see p. 92 this issue.

407,781. Galvanic Battery; William P. Kookogey, of Brooklyn, Assignor to the Kookogey Electric Company, of New York, N. Y. Application filed Apr. 27, 1888. In an electro-galvanic cell, the combination of an electrode provided with a hook shaped top, with a support from which the electrode hangs, such support having a groove or cavity to contain mercury.

407,799. Telephone; John Trowbridge and Samuel Sheldon, of Cambridge, Mass. Application filed Dec. 17, 1888. In a telephonic receiver, the combination of a small movable coil, through which the feeble telephonic currents are passed, and a fixed electro-magnet, the strength of which can be increased indefinitely, the movable coil being so placed in respect to the fixed magnet as to embrace the fewest possible lines of force of the fixed electro-magnet; that is, it is in the magnetic field and substantially parallel with the direction of the lines of force. See illustration.

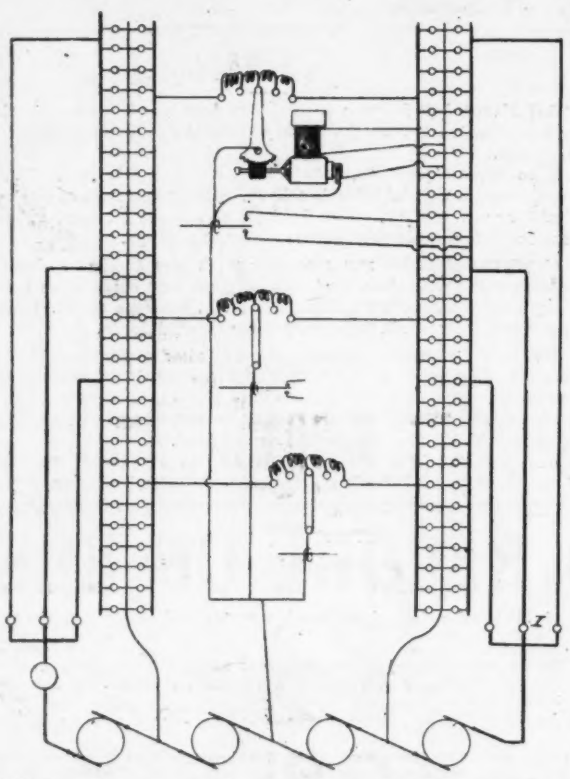
407,844. Alternating Current Electric Motor; Elihu Thomson, of Lynn, Mass. Application filed Nov. 17, 1888. The invention consists in the combination of a set of energizing coils supplied with an alternating current of substantially the same phase in all the coils, and a set of coils inductively related to the first and kept in continually closed, preferably uncommuted, circuit while the motor is running, one or the other, or both sets or systems of coils, being movable, as in ordinary electric motors. See illustration.

407,875. Alternating Current Dynamo; Gustav Pfannkuche, of Cleveland, Ohio, Assignor to the Brush Electric Company, of same place. Application filed Dec. 2, 1887. The present invention has for its object the construction of self-exciting alternating current dynamos in which the same principles are involved which form the basis of the compound continuous current dynamo, whereby separate exciters are made unnecessary, the construction simplified and the effective operation rendered more certain and more economic.

407,895. Electric Lighting System; Frank E. Kinsman, of Plainfield, N. J. Application filed Oct. 13, 1889. The combination, with the primary and secondary circuits and the converter therewith connected, having a small wire in the primary and a large wire in the secondary, of an arc lamp having a carbon holder, a helix in the secondary circuit, and a tubular core divided longitudinally and projecting below the helix and mechanism for connecting the carbon holder and core for regulating the carbon holders.

407,914. Electric Projector; James J. Wood, of Brooklyn, N. Y. Application filed Oct. 1, 1888. In combination, with a projector casing, of a base supporting it and a swivel joint between the base and casing having an axial opening, an electric lamp within the casing, and the circuit leads thereof passing from the base through the axial opening in the swivel and into the casing and stops on the respective members of the swivel adapted to limit the rotation of the casing on the base, and thereby prevent the excessive twisting of the leads.

407,915. Focusing Arc Lamp; James J. Wood, of Brooklyn, N. Y. Application filed Oct. 1, 1888. The invention aims chiefly to overcome the disadvantages of prior constructions, and provide a focusing lamp which shall be as compact as possible, the dimensions of which shall be distributed as nearly as possible above and below the focal axis, and the weight of which shall be



407,485. Multiple Wire System of Electrical Distribution.

so distributed that it shall act to counterbalance the weight of the reflector in a pivoted projector casing and avoid the necessity of idle counter-balancing weights.

407,931. Galvanic Battery; Charles J. Hirliman, of Fort Lee, N. Y. Application filed. In general terms, the invention consists of two carbon boxes or rectangular structures, one placed within the other, and the two being joined together at one end, thus forming a chamber or receptacle between the outer and inner boxes. A free passage is left through the inner box. The outer box is formed with two ears projecting above the mouth of the jar or cell, in which are fitted binding posts for making connections. Any usual depolarizing agent is placed in the chamber between the two boxes and sealed in by wax or in any other suitable manner. The whole is then placed in a suitable jar, preferably rectangular in shape and containing the electrolyte. See illustration.

407,945. Electric Clock for Use in Exposed Places; Alfred Speer, of Passaic, N. J. Application filed Sept. 22, 1888. In a clock the combination, with the hour and minute hands, of propelling mechanism attached to the pointing ends of the hands.

407,950. Stop Motion for Dental Engines; Augustus R. Cooke, of Syracuse, N. Y. Application filed April 8, 1889. The object of this invention is to provide ready means for connecting and disconnecting the dental engine with a continuously revolving driving pulley, and to enable the dentist to start and stop the motion of the dental instrument without interfering with the operation of other instruments or machines driven by the same motor, as in large dental offices or clinic rooms of dental colleges, and whenever it may be desirable to use more than one instrument simultaneously, in which case the invention permits all the instruments to be operated independently of each other by one and the same motor.

408,002. Secondary Battery; Victor H. Ernst, of Jersey City, N. J. Application filed Feb. 13, 1889. A storage battery plate having a body of active material with a yielding or absorbent core of material indestructible by the acid of the battery, and having a series of fibrous ends or leaders projecting from the core into the active material of the plate.

(1) 408,013. Electric Meter; (2) 408,017. Electric Meter; Edward R. Knowles, of Brooklyn, N. Y., Assignor by mesne assignments to the Mutual Electric Manufacturing Company, of New York. Applications filed (1) Oct. 29, 1888; (2) Feb. 14, 1889. For description see The Electrical World, July 20, 1889.

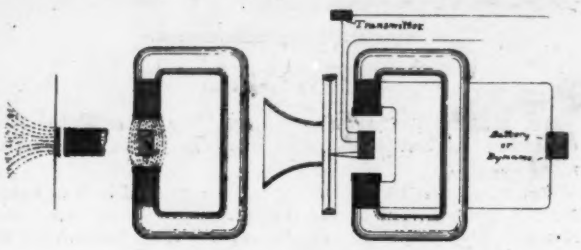
408,018. Electrical Indicator; Edward R. Knowles, of Brooklyn, N. Y. Application filed March 5, 1889. An indicator to be placed adjacent to a conductor of electricity to indicate the direction in which the current is flowing. It comprehends a casing in which is pivoted a needle. A window in front of the casing exposes the needle when the current is flowing in the right direction.

408,042. Electric Signal-Box; Don A. Palmer, of Englewood, Assignor of one-half to Bernard E. Sunny, of Chicago, Ill. Application filed Dec. 12, 1888. The combination, in an electric signal-box, of a character wheel consisting of two portions, each portion being provided with character teeth, and the one portion being fixed and the other removable, whereby on inserting the removable portion the number thereon and the number on the fixed portion will be transmitted successively on turning in the box.

408,045. Protecting Case for Armatures; Andrew L. Riker, of New York, N. Y. Application filed April 24, 1889. A dynamo or motor having its armature protected by a hermetically closed metallic case fitting closely around the armature.

408,112. Means for Measuring and Regulating the Charge and Discharge of Secondary Batteries; William P. Kookogey, of Brooklyn, N. Y. Application filed July 5, 1888. The invention consists, in general, of the introduction into the charging and working circuits of an electro-depositing cell, one of the plates of which is attached to one end of a balance beam and moveable under the influence of gravity, the other end of the balance wheel operating circuit connections in the charging-current passing through the depositing cell in one direction and the discharging current in the opposite direction. When the movable plate, by the deposition of metal upon it through the action of the charging current, has reached a certain predetermined weight, that end of the balance beam descends and thereby opens the charging circuit at the other end of the beam. The discharging current, as soon as the working line is closed, then passes through the depositing cell in the opposite direction, and the metal is removed from the movable plate. The working circuit is not opened by the action of the balance.

408,138. Method of Gelatinizing Electrolytes for Galvanic Batteries; Paul Schoop, of Zurich, Switzerland. Application filed March 30, 1889. The method of converting the



407,799. Telephone.

electrolyte of a galvanic battery or pile into a gelatinous mass by the addition to said electrolyte of a sufficient quantity of water glass.

408,151. Electric Eyeglasses; Hermann Welcker, of Berlin, Germany. Application filed April 25, 1889. The combination, with an eye glass frame comprising a bow spring of opposite nose plates, insulated from each other by an insulating plate between one nose-plate and the frame, a battery element, an electric conductor connecting one pole of the battery with one nose plate and an electric conductor connecting the pole of the battery with the opposite nose-plate.

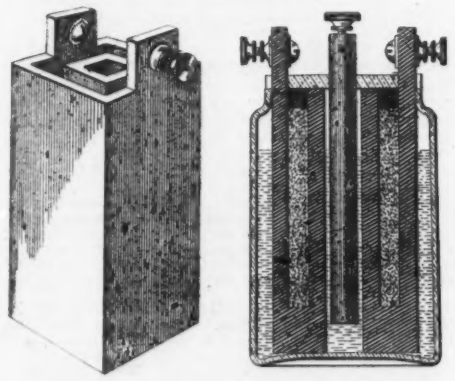
408,157. Electric Measuring Instruments; John A. Barrett, of Brooklyn, N. Y., Assignor to the John A. Barrett Battery Company, of Baltimore, Md. Application filed April 16, 1889. In a galvanometer having an inclosing case provided with an opening or window, and having a deflecting coil and an index therefor projecting in proximity to said window, the combination therewith of a scale carrier adapted to manual rotation, so as to present different sides to the window, and having two or more scales on its surface. See illustration.

408,194. Electric Switch; Harry Tilden Riggs, of Farmington, Me., Assignor of one-half to Alvin S Riggs, of same place. Application filed Feb. 19, 1889. In an electric switch, a centre rotating post having attached thereto by means of lateral arms two contact pieces or lugs, the said post being hollow and the two terminals of the circuit entering the structure of the switch through the hollow post, and extending through lateral openings in said post to the contact pieces or lugs mentioned, all in combination with a base piece, which supports the said post and also two terminals of a circuit corresponding to the terminals fixed to the post. See illustration.

PATENTS EXPIRED JULY 30, 1889.

129,881. Improvement in Electro-plating with Nickel and other Metals; George W. Beardslee, of Brooklyn, N. Y. The combination, in the formation of an electrode to be used in the process of the electro deposit of metals, of an electrical conductor with holder or cover inclosing in a granular or fractured state the metal to be dissolved and deposited.

129,945. Improvement in Insulating Sewing Machine Treadles; William H. Gordon, of Waltham, Mass. The combination of an insulator and a machine pedal.



407,931. Galvanic Battery.

130,048. Improvement in Telegraph Sounders; George B Hicks and George W. Shawk, of Cleveland, O. In telegraph sounders or relays the combination of one or more adjustable pole pieces with one or more magnets.

PATENTS EXPIRED AUGUST 7, 1889.

130,252. Improvement in Printing Telegraph; Martin F. Wessmann, of Brooklyn, N. Y. The printing magnet operated through a local or separate circuit by a circuit closer held open by the clinging of an armature to a magnet in the main circuit during the breaking and closing of said main circuit in moving the type wheel, but closed and brought into action by the cessation of that movement on the open main circuit after the type-wheel is brought into position.

130,260. Improvement in Printing Telegraph Instruments; Martin F. Wessman, of Brooklyn, N. Y. A printing telegraph instrument constructed so as to effect the printing automatically by the cessation of the step by step movement of the type wheel and the recommencement thereof for the next letter or character.

130,261. Improvement in Printing Telegraph Instruments; M. F. Wessman, of Brooklyn, N. Y. A printing telegraph instrument, constructed so that with one line wire and a local printing circuit it prints automatically and leaves the local circuit either open or closed.

130,281. Improvement in Electrical Water and Pressure Indicators for Steam Boilers; John D. Coughlin, of New York, N. Y. The combination with one electrical circuit and alarm bell the low water indicator and pressure indicator.

Copies of the specifications and drawings complete of any of the patents mentioned in this record—or of any other patents issued since 1866—can be had for 25 cents. Give the date and number of patent desired, and address The W. J. Johnston Co. Ltd., Times Building, N. Y.